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Section

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AN
ESSAY
ON
CURVATURES AND DISEASES
OF THE
SPINE,

INCLUDING ALL THE FORMS OF SPINAL DISTORTION:

TO WHICH

THE FOTHERGILLIAN GOLD MEDAL WAS AWARDED BY THE
MEDICAL SOCIETY OF LONDON;

BY

V
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Fellow of the Medical Society of London;

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EDITOR'S PREFACE.

ALTHOUGH much has been written on curvatures of the spine, since the publication of Mr. Bampffield's elaborate work, but little theoretically true or practically useful has been added to the stock of knowledge on this important subject, except, perhaps, in the better adaptation of mechanical means of support and extension, and the application of veratria and iodide of potassium to the neuralgic and scrofulous forms of this protean disease.

But little additional matter is, therefore, appended by the Editor, and that little is drawn chiefly from American authorities; for it would be of no great use to the reader to describe the already abandoned muscular section of Guerin, and the hundred complex and irksome instruments to extend or compress the spine, each of which is but the expression of the inventor's ignorance of the more simple and useful mechanism already appropriated to the same purpose.

Much pains have been properly bestowed by the Author on that part of his work which treats of the forming stage of spinal distortion, and the Editor earnestly invites, to his strictures on it, the attention of the profession. The greater part of these terrible maladies are not intractable at their

commencement, and may be then remedied by few and simple measures. But when the disease has begun to vitiate the condition of the *medulla spinalis* or its meninges, or to subvert the form and composition of the bony and cartilaginous constituents of the spine, much time, long suffering, and persevering skill are necessary to even the chance of a cure.

Whenever, therefore, a child complains of unwonted lassitude, of tenderness in the back, or of constant pain in the side when seated, or drags its legs awkwardly, or begins to trip and fall in an inexplicable manner; or still more, when the dress-maker finds it difficult to obtain a "neat fit," or the shoulder blade projects, or the line of the shoulders is inclined, we should examine well the spine, both as to sensibility and shape. Thus may be frequently detected an insidious disease, just at its outset; when alone the resources of art can, for its correction, be easily and happily applied.

J. K. MITCHELL.

AUTHOR'S PREFACE.

OF the various ills that man is heir to, there are few more afflicting and lamentable than diseases of the various structures of the spine. They are replete with present suffering, whether their progress be rapid or slow ; they often leave permanent weakness and dyspnœa ; their issue is often fatal ; and they too frequently entail consequences, which disfigure the majestic form of man, created after the Divine Image, and render it unequal to many offices of life.

With these evident facts, it may excite our surprise, that spinal diseases and deformities have been so little noticed by our professional ancestors, that hardly any writers, before our own times, have devoted more than a few pages to their consideration ; in which, the means of cure detailed have been futile, inadequate, or improper. The spirit of investigation that characterises the present age, has directed its researches into every department of medicine and surgery, and spinal diseases have been included within the circle of its enquiry, as many late publications evince.

Since the printing of periodical medical works, numerous isolated facts have been recorded relative to spinal diseases and lesions, which, brought into one digested view, may prove a valuable collection, from which general legitimate inferences may be deduced, and general principles established, and of many of which I have availed myself.

The immense population of the British metropolis favours this research into particular and rare diseases, and facilitates the acquisition of experience and practical facts, whilst an impulse and encouragement to such useful and exclusive investigations are given, by the prospect of obtaining, from so large a population, a compensation for the most fatiguing labours, such as the attendance on those diseases has occasioned me. Rome, in the zenith of her greatness and during her most numerous population, had separate practitioners for many diseases, and such will probably be the case in London, if the increase of its population proceed at its present ratio.

Soon after my establishment in London, on the return of peace, some very interesting cases of spinal curvature were placed under

my care, which induced me to consider how much those distressing affections were neglected by parents, and how little was attempted for their relief, even by the most justly eminent men, when they were submitted to their treatment. I, however, despaired of obtaining, in private practice, sufficient experience in those and other spinal complaints, to render the desire of investigating them either useful or interesting. On my being elected one of the surgeons to the Royal Metropolitan Infirmary for Diseases of Children, as many cases of spinal curvature and other spinal diseases presented themselves, as it was possible for me to give due attention to. Hence, two years ago, I began to publish a series of cases and observations on the subject, in the ably conducted London Medical and Physical Journal, without observing any regular order or connexion; when the Medical Society of London informed the Profession, they had selected spinal diseases as the subject of an Essay for the Fothergillian gold medal. This induced me to arrange the facts and observations I had collected into something like the order observed by Dr. Cullen, in treating the successive topics appertaining to diseases, and to send the Essay in as concise a form as possible as one of the candidates; conceiving that, if it were adjudged the best by that learned body, as it has been, it would encourage my pursuits, reward my labours, and be a passport to the favour of the public.

The Essay now offered to the public, is the one to which the Fothergillian gold medal was awarded, with some addition of cases and remarks, and some quotations and references to the very recent works which have been published since this Essay was delivered to the Society's Registrar, in December, 1823.

Since that period, there have appeared, in succession, five works of merit, in various degrees, on spinal curvature and diseases; three of which, by Mr. Shaw, Dr. Dods, and Dr. Jarrold, principally relate to lateral curvature of the spine: although, indeed, Dr. Dods chiefly refers to a variety of this species, attended with a contortion or twisting of the spine. Mr. C. Bell has lately published a Lecture on Injuries of the Spine, which conveys some information in the language of controversy. Dr. Ollivier, a learned Frenchman, has also published a Prize Essay on the Spinal Marrow, in which he has amassed many valuable facts relative to its diseases; in reviewing which, a very able and intelligent article appeared in Dr. J. Johnson's Medico-Chirurgical Review, for June, 1824, in which many important facts and cases were added.

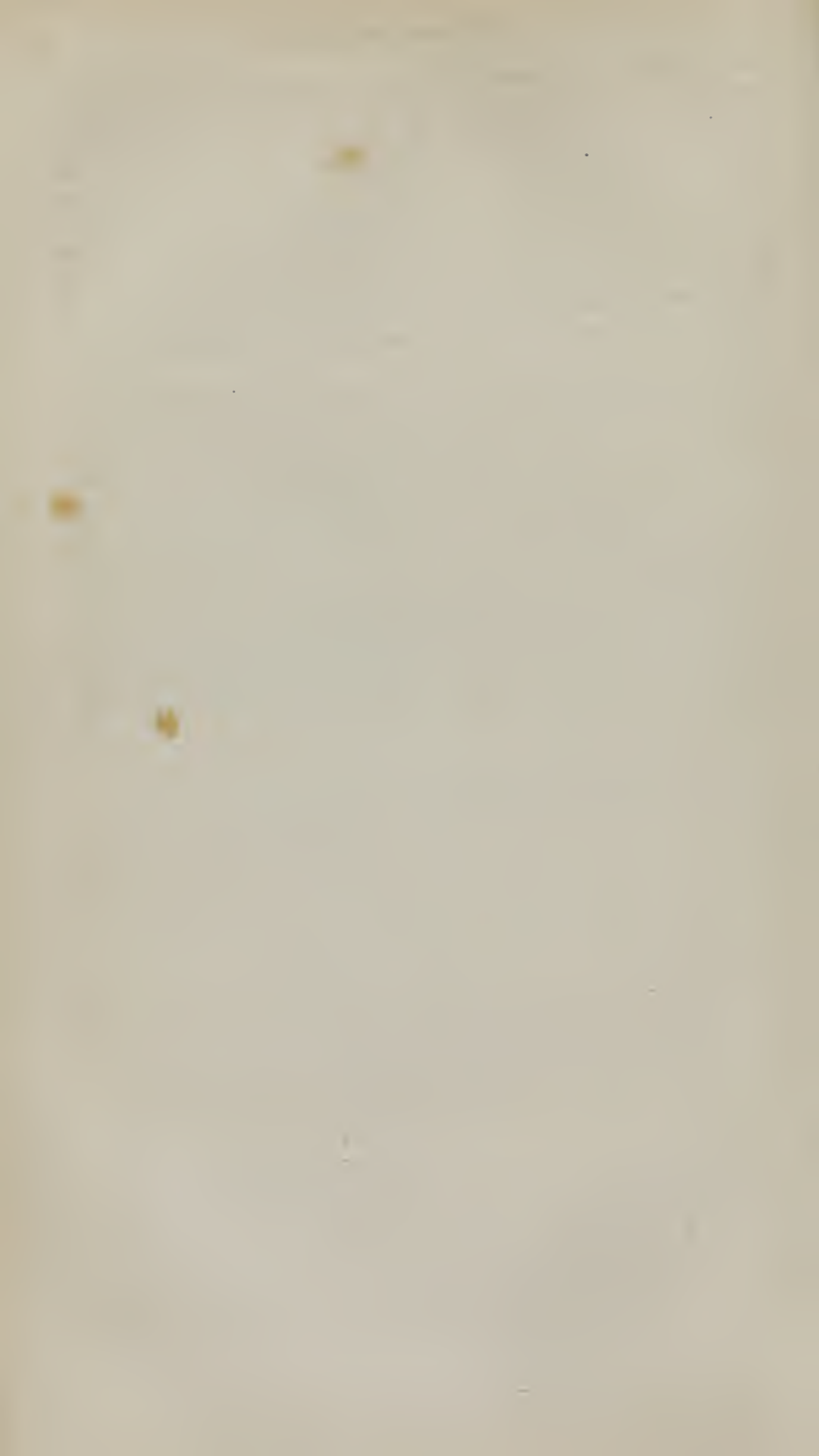
It may be proper to remark, that this Essay was delivered to the Society's Registrar before any of the above publications appeared, and that it was not restored to me until June, after the Society's Meetings were adjourned for the Summer vacation, with an understanding that it was returned for the purpose of publication. It is, therefore, hoped, that I shall not be accused of plagiarism or want of originality, from any coincidence of new opi-

nions that may be observed between this Essay and the recent works already alluded to, as, in fact, this Essay has the priority.

Wherever I have added to my Essay, during its printing, from any of those valuable publications, I have quoted them, as, also, where their observations confirm my own, and most of my contemporaries will find their writings referred to, who have published any thing of value on the subject; by which, it is trusted, an example of disregarding the little jealousy that conceals the names of contemporary labourers and rivals, has been set, that, if followed, will give *cuique suum*, and promote the welfare of the profession, and ensure harmony among its most industrious members.

Notwithstanding this Essay has been so highly honoured by the Medical Society of London, it is a justice due to them to state, that they are not answerable for any faults or imperfections the critic may detect; — these are my own; and if there be any proposals, information, or facts, that may be deemed original and valuable, it is to those only, they have awarded the reward left by Dr. Fothergill. The whole has been undertaken in compliance with the command which directs all men to cultivate and improve their “talent” to the best advantage; and, as the motives for the work are laudable, I have the most perfect confidence it will be treated with indulgence, as no new attempt was ever perfect, and I believe this is the first Essay that has classed and brought into one view and volume, the various Curvatures and Diseases of the Spine.

37, Bedford Street, Covent Garden.



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AN
E S S A Y
ON
CURVATURES AND DISEASES OF THE SPINE.

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Hic patet ingeniis campus, certusque merenti  
Stat favor, ornatur propriis industria donis.  
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CHAPTER I.

SECT. I. — *General Anatomical Observations.*

THE sublime privilege of standing erect, with the eyes directed to the star-decked vault of heaven, has been exclusively granted to man, and confers on him peculiar advantages and dignity. To preserve to him this valuable attitude, the all-wise Creator has constructed the spine like a pyramid, differing, indeed, from the motionless piles of architecture, for its mechanism is inimitable: still, from its shape, it has been long compared to two pyramids with a common base; but the upper one, that is formed of the twenty-four true vertebræ, by which the several motions of the trunk of the body are performed, is the particular subject of this dissertation, because it is the seat of the diseases and deformities intended to be discussed and treated of.

The general cultivation and study of anatomy render it unnecessary to enter into a minute anatomical description of the spinal column; it will be almost sufficient to observe, that it is composed of twenty-four joints, forming a canal for inclosing the medulla spinalis and its membranes, which are moveable, strongly conjoined by ligaments and intervertebral substance, and, as a whole, admit of considerable flexion forwards, of a small degree backwards, and of some extent of lateral motion; but, by whatever causes a deflection is made from the straight or erect position, adequate moving

powers are provided to restore it to its natural and noble attitude, as long as the primary form of the body is preserved entire, the muscles retain their contractile powers, and the different bones of which the spinal column is formed, preserve their relative proportions. From the complicated mechanism of the spine, by which all its various parts are adapted with so much wisdom and order to the different purposes which they were designed for, and its movements balanced with so much exactness and care to secure the structure from being deranged or displaced; from the strong muscles spread over the posterior part of the vertebræ, to prevent the column from falling into a permanent inflection forwards; from the disposition of the numerous bony processes, and the insertion of the ribs, which secure so many of the vertebræ from being displaced laterally and anteriorly; from the strength and number of the ligaments, which are unyielding, almost inelastic, and which connect the joints of the vertebræ with a firmness and power more than equal to protect them against all ordinary exigencies or ordinary force to be resisted, so that fractures of the bodies of the vertebræ are, beyond comparison, more numerous than dislocations: — from all these wise provisions of the Creator, and some minor ones not enumerated, it would, *à priori*, seem scarcely possible that distortions of the form and derangements of the order of this structure should so frequently present themselves; for, viewing the spinal pyramid as a piece of mechanism judiciously constructed and artfully secured, it might be inferred that no mechanical power but the wedge could permanently displace any of its parts; yet this deformity has existed, and has engaged the descriptive pen of poets and of surgeons, and its cure, alas! has baffled the attempts of preceding ages, — at least such a cure as generally restores the vertebræ to their natural condition, position, and powers of movement.

The medulla spinalis and its membranes are so safely enclosed in the centre of bone, and so powerfully protected within the spinal canal, that they might be supposed to be beyond the reach of accident or the impression of external or physical agents, and to be secured from the invasion of disease or the derangement of morbid action and alteration; pathological anatomy, however, has dissipated those physiological speculations, and proved them to be merely fanciful.

SECT. II. — *Nosology of Diseases of the Spine.*

The diseases of the spine may be divided into those which chiefly affect the bones and joints of the vertebral column, and those which affect the medulla spinalis and membranes, and may be arranged for dissertation in the following order: — 1st, Curvature and Distortions of the Spine. 2d, Fractures, Concussions, and Dislocations of the Vertebræ. 3d, Spina Bifida, and some other congeni-

tal defects of spinal conformation. 4th, Inflammation of the Medulla Spinalis and its Membranes. 5th, Of some other affections of the Spine; and of some diseases which are said to originate in its derangement.

SECT. III. — *Nosology of Curvatures of the Spine, and the Definitions belonging thereto.*

The Nosology of Curvatures of the Spine is wanting. Dr. Cullen has not assigned them a place in his System, in consequence of having omitted the class, deformitates et genus distortio. Nor have Vogel, Sagar, Sauvages and Linnæus agreed in their definition of the terms applied to them, by which much confusion and perplexity prevail. Thus, Linnæus defines Gibber to be Thoracis Dilatatio prominens — *Or.* 7. 301: and Vogel, to be Pro-tuberantia Spinæ Dorsalis, &c. *Cl.* 1. 512. Gibbositas is a term used by Fabricius and some old surgical writers to denote curvature of the spine, whilst Sauvages and Sagar confine it to a distortion of the bones of the chest or pelvis. Vogel, with his usual copiousness, enumerates four species of gibber — cyphosis, lordosis, scoliosis, et seisis; but all the Greek derivatives of these terms imply tortuous or curved, and their definitions have not been fixed and agreed upon. For instance, the definition of lordosis is applied to the inflexion of the long bones by Sagar; of the bones generally by Linnæus, and to general distortions of the bones by Sauvages. The celebrated Mr. Pott has described curvatures of the spine under the title of “Palsy of the Lower Limbs,” which is only a symptom attending these and other affections of the vertebral column. More recent writers divide the genus into two species; — “angular and lateral curvatures,”* which comprise all the varieties. Very proper objections may be offered to the term angular curvature, which will be dispensed with, as the existence of such a curve or arc has not been demonstrated, and as it unquestionably appears to be a mathematical solecism, for an angle cannot be a curve nor a curve an angle, although every curve contains an angle, and, because it does not convey any distinct or true idea of the nature and form of the three varieties of spinal distortion it comprehends, which are attended with projections from the natural axis of the vertebræ either outwards or inwards.

The distortions and projections of the spine may be still divided into two species, one of which will be denominated curvature of the spine, and the other, the angular projection. Of the former there are three varieties; the first of which for the sake of brevity it is proposed to term an excuvation of the spine, or curvature outwards;† the second, an incurvation of the spine or curvature

* Lloyd on Scrofula.

† Excuvation is not a genuine English word: it is trusted, however, its use

inwards ; the third, lateral curvature, which has, with propriety, been generally employed to denote the curvature on either or both sides. The angular projection has not any varieties.

Curvatures of the spine may take place in any portion of the spinal column ; they, however, most commonly occur in the dorsal vertebræ. A curvature of the spine forms the segment of a circle, the arc of which is more or less regular and perfect. The most perfect curves are formed by the dorsal vertebræ, which frequently include the whole twelve. There is an outer line of curve, commonly termed the convex side of the curvature, and an inner line of curve, as often named the concave side. The curve may be divided into two extreme points, and a centre or middle, which is its angle. This centre of the curve becomes the centre of pressure from superincumbent weight, as will be proved in the sequel, and is an expression to be remembered. The angular projection generally takes place in the lower dorsal or lumbar vertebræ, and commonly involves some of the dorsal. To understand the form of this projection, it is necessary to define that the term spinal line, which will be so often employed, means the line the vertebræ or spinal column ought to make and does make in its natural and undeformed state, and differs somewhat from the meaning attached to the term, axis of the vertebræ. The angular projection of the spine forms the projecting line of an acute angle with the spinal line, the quantity of which varies in the degree the spinous processes project beyond their natural situation. The spinal line, the projecting line, and the line formed by the lower surface of the most projecting vertebræ, form a triangle, of which we will consider the last with its spinous process to be the base.

Curvatures of the spine have been denominated either temporary or permanent. Temporary curvature implies a distortion of the spine removable at will, sometimes with and sometimes without the aid of mechanical assistance. Of this kind are inflexions forward with excurvation from paralysis or debility of the muscles of the back ; lumbar incurvations, when in the erect attitude, in cases where there is permanent contraction of the flexor muscles of the thigh ; and almost all curvatures are temporary in their incipient stage. In all such instances the structural parts of the spinal column still preserve their relative proportions, and not any of the bones and intervertebral substances have been reduced to a cuneiform shape, or entirely destroyed. Permanent curvature is generally intended to imply a distortion not removable at will or at once, even with the help of mechanical power, in which the structural parts of the spine have lost their natural proportions, and some of the bodies of the vertebræ or intervertebral substances have become cuneiform or destroyed ; but which admits of the pos-

will be excused ; for, as incurvation very aptly expressed one condition of the curved vertebræ, it was thought excurvation might be as fully employed in contradistinction.

sibility of their being ultimately restored. Permanent curvature, however, must be perpetual, while many of the bodies of the vertebræ are destroyed or taken away, either by caries or absorption, or where progressive absorption of the cartilages occurs (as in old age), after nature has withdrawn the power of regeneration.

Curvatures and projections of the spine are most commonly formed during the growth of the body, and from the age of one to twenty-one years; they however occur, with less frequency, from this age to that of forty years; beyond which period of life Mr. Pott says he has never seen it;* but my worthy friend, Mr. C. Hutchison, did me the favour to show me a case of excurvation of the spine in Elizabeth Charles, at the Cock and Bottle, in the Strand, who was forty-six years old. The excurvation of old age is obviously formed at a more advanced period.

Since the days of the celebrated author, whose name is by a sort of prescriptive right associated with this disease, so that our French neighbours denominate it "*Maladie de Pott*," it has been, until very recently, fashionable to admit, that wherever there is curvature of the spine, there must exist caries as a cause, arising chiefly from scrofulous action; but the first part of this position is generally incorrect and untenable, as the cases of curvature without caries are far more numerous than those in which caries occurs; and if the nosological division of those diseases already proposed, had not appeared more perspicuous and convenient, I should have adopted the nosological distinction of curvatures into those with, and those without, caries.

CHAPTER II.

EXCURVATION OF THE SPINE.

SECT. I. — *History and Symptoms of this Disease.*

THIS variety of spinal distortion is more frequently formed than any other;^a and on this account, may be first considered. It is induced during childhood, puberty, and more rarely in adult age. In old age the curvature of senility sometimes occurs, and might

^a [We are unable to admit the greater frequency of this form of spinal distortion in girls. It is so in boys, who are seldom affected with any other form; but girls are much more frequently attacked by lateral curvature. — Ed.]

* Further remarks on the useless state of the lower limbs, p. 9.

be generally considered a natural deformity rather than a disease, and will be alluded to for the sake of illustration. The occurrence of this variety of disease at various periods of life, and from different causes, occasions the symptoms to differ in some respects, but so materially as to prevent me from attempting a general history of the progress and effects of the complaint.

The commencement of excurvation of the spine is sometimes marked by pain of the vertebræ about to be involved in the curvature, which is more particularly felt on using exercise, in the erect posture, or may be, at all times, excited by pressure on the spinous processes; in the latter case, an adult would shrink from the pain and mention it; a child would cry. Should inflammation of any of the constituent parts of the vertebral joints exist, the pain would be of a more permanent nature or of more frequent recurrence, and the patient will be considerably relieved by assuming the horizontal posture, and in a less degree by bending the spine backwards. The majority of cases are not preceded by any pain of the vertebræ, that attracts so much attention, or occasions so much suffering as to lead to voluntary complaint. In some cases, chiefly in those accompanied with inflammation, if a sponge wrung out of hot water be passed along the spine, it will create increase of heat and pain in the part disposed to curvature, but this is not a result obtainable in the generality of cases. An adult generally states the pain to be of an obtuse kind and feeling like a weight, but it can only be inferred that a young child feels pain by its crying, when made to sit up or walk about. At this period, if the spine be accurately examined, particularly if it be bent a little forwards, some of the spinous processes of the dorsal vertebræ, which are the seat of pain, may be observed to project more irregularly than the rest, so that they stretch the skin over them, and make it appear white and shining, resembling the phenomenon of the stretched skin over the knuckles of a clenched fist; yet this appearance of the curvature at its commencement is only of a temporary nature, as by laying the patient in a proper horizontal posture, and using mechanical aid, the vertebral column can be restored to its spinal line. About the time the above evidence of incipient curvature is manifest, many adults will complain of a sense of weakness in their back, of a lassitude that disinclines them from exertion, and of fatigue being soon induced by exercise, all of which dispose them to seek repose and avoid motion. A child, if he have not previously gained the use of his legs, has the ability of using the lower limbs deferred long beyond the usual period children should walk, and if he had acquired the power of walking, he will gradually lose that remarkable spirit of activity and endless motion peculiar to children, and become listless and languid, seeking its mother's lap for a resting place. Should these symptoms of weakness and indisposition to exercise lead to the frequent adoption of the recumbent posture, the curvature will increase very slowly, or its progress may be arrested for a time. Should,

however, the patient not lie down more than usual, but be seated in a chair during the day, where the vertebræ will have to bear the superincumbent weight of the head, &c., especially if he walk about as much as he is able, the curvature will advance with considerable rapidity, and after a little increase, if the patient be placed on his feet, he cannot maintain the vertebral column in the erect attitude, but inclines the upper part forwards; and he moves with a slow, hesitating, tottering gait, and is soon tired, or he cannot direct his steps to the proper point, and he stumbles, trips or crosses his legs, and falls down crying.^a In this state a child dreads to be put down, and when on his feet will, with tears, cling to his mother or nurse for support, and if deprived of it, he will totter, his knees will bend, and he will soon fall, unless caught. The lower extremities gradually diminish in size, as the curvature advances, and frequently lose part of their natural sensibility and temperature; the muscles exchange their plump and firm feel, for a softer one, and their power daily decreases. The patient will often sit with his legs crossed, and in bed will sometimes experience pain in his knees, and convulsive actions of the muscles of the thighs, which are more particularly felt and described by the adult, whose loss of muscular power is more generally accompanied with a sense of coldness and diminished sensibility and firmness of the extremities. If a palsy of the lower limbs be now induced, there is of course an end to locomotion; the muscles and cellular texture of the extremities waste and wither; the limbs become flaccid and cold, and, if lifted up, will fall down like a mass of inanimate matter; the joints are more rigid than in ordinary paralysis, and the skin frequently retains some power of sensation. This calamitous effect or symptom, however, only supervenes occasionally, for the majority of adults and minors retain sufficient muscular power of the extremities to enable them to move about in their room, with the artificial aid they can derive from the chairs, tables, and other supports that are available in their route. Should they attempt it without such extrinsic aid, or the use of crutches, or the support of friends, they can only walk a short time with such a degree of bent posture, as the curvature necessarily occasions, and suddenly lean forwards and support themselves, by placing their hands above their knees; and the vertebral column then becomes curved to a great extent. — Most patients, if not prevented by paralysis, or restrained by medical advice, retain the disposition, which they indulge in, to sit up and walk about a little through the whole progress of the disease; but where *scrofulous caries* is the cause of the curvature, the inclination to move

^a [An awkward gait, a tendency to totter or fall, or to drag one leg, are among the earliest symptoms of spinal disease; and are present often, long before any distortion is discoverable. Previously to these symptoms, there often exists a sense of weariness and a disinclination to physical exertion. — Ed.]

about very frequently forsakes them, and they sit in a chair, listless, languid, often asthmatic, or affected with dyspnœa, and endeavour to take off the superincumbent weight of the head, by placing the elbows on the table before them, or on the arms of their chair, and lodging their lower jaw on the thumbs (as on a crutch) extended across it, with the fingers directed up to the sides of the face or ears. If the patient be confined to the horizontal posture, more especially the facial, when the excurvation is in the incipient stage, no permanent or perpetual curvature will ensue, provided its use be persevered in, until the dorsal muscles have recovered their energy, or the disposition to inflammation and scrofulous action of the vertebræ be removed. Should the patient incautiously continue to sit up and walk about, a curvature of the spine ensues and gradually increases: the first appearance of projection has been described, and in a short time after, one, two, or three spinous processes of the dorsal vertebræ may be observed to project beyond the spinal line a quarter or half of an inch; after this the spinous processes of the vertebræ above and below those previously projecting successively protrude, until many or the whole of the dorsal vertebræ form a curve, and are projecting backwards beyond the spinal line from an inch to even two inches, the chord-line of which does not admeasure much more than one half of the length the vertebræ of their natural dimensions and breadth would occupy. The lower cervical vertebræ naturally incline forward from their junction with the first dorsal; but in the state of dorsal curvature just described, they become placed almost horizontally in the erect attitude of the body. As the curvature increases, the spinous processes of the dorsal vertebræ gradually separate from each other; but the greatest degré of separation takes place about the middle of the curve, where the space of half an inch is left between them, and the fore-finger can be easily inserted. When they are separated at this distance, it may be always inferred with much probability, if not certainty, that the horizontal surface of the bodies of the vertebræ, of which these spinous processes are corresponding parts, are either greatly or wholly absorbed, as well as the intervertebral substances between them. Excurvation of the spine is generally accompanied with distortion of the costæ and sternum. During the formation of an excurvation, the general health becomes impaired, and particular organs and functions suffer derangement, the symptomatology of which cannot be very briefly disposed of; for although the description drawn may enable the surgeon to distinguish the disease in its different stages, yet it is necessary to a due comprehension of it, to enumerate and examine the evils it brings in its train, and to take a review of many of the morbid effects it produces on the various structures, systems, organs, and functions of the body.

SECT. II. — *Affections of the Muscles.*

The loss of power, of density, and of firmness of the muscles of the lower extremities has been already adverted to, in describing the disease. The muscles of the back generally evince debility. In children, this debility may be native, or at all events, it may not have been acquired, so as to display itself, or it may have been fully developed and subsequently diminished or lost. An adult will often state, that a perception of weakness in the back was the symptom that first indicated the approach of the disorder, and he will describe the progressive increase of this weakness, with a corresponding incapacity to maintain the vertebral column erect for any long period of time, the duration of which daily becomes more limited, until he can hardly, with the greatest exertion of the will, preserve the muscles of the spine in a state of powerful contraction for more than a few minutes; and if the attempt be persevered in, the muscles yield suddenly, and the head and parts above the curvature fall as suddenly forward. At length, he cannot maintain his spine upright when standing; and whilst sitting, he is obliged to support the upper part of the body by resting with his arms or elbows on some collateral fixture, from which cause the skin over the elbows is generally rendered thick, coarse, and hard, by the pressure it is subject to.

Those muscles of the back attached to the processes of the vertebræ, that are situated on each side of the spine and between the processes of the vertebræ, are elongated in proportion to the degree of excurvation, in consequence of being made to take a circular detour around the convexity which they were not intended by nature to perform, and of the more distant separation of some of the processes from each other. The dorsal muscles also appear to be diminished in size or density, more particularly around the middle or the most projecting points of the curvature; an appearance which is verified by dissection. After death, those muscles are paler than the other muscles of the body, particularly in the situations last described.

The abdominal muscles and diaphragm have their structural positions deranged, so that the functions of respiration, &c., in which they are engaged as most important and indispensable agents, become impeded or disordered, and cannot be performed with the same order and effect they are, when the structure of the spine and chest is natural, and the body is in health. The defective action of these muscles may be accounted for by the ordinary principles of muscular motion. The contraction of the voluntary muscles is either active or passive: active, in obedience to volition, to the laws of association and to stimuli; passive, as when the legs, arms, or body are bent mechanically during sleep or the delirium of fever, when the mind is not conscious of it. During every state of contraction the muscle is shortened, and the force of contraction must

be in the ratio of the length of the muscle, of its velocity of contraction, and the quantum of space through which it can contract; and the power or strength of a muscle is in the ratio of its length and thickness combined. Muscles of equal length and density may differ in their capacity of contraction, if situated in different parts, some contracting to a shorter compass or space than others; but by the law of nature there is a fixed point of contraction allotted to all, at which they must cease, or their attachments must break. From which premises, it may be deduced, that if a muscle be permanently bent or contracted to one half or any portion of the space to which its capacity of contraction extends, it must lose all the power, that length of contraction exerted and possessed, as will be presently exemplified. When the body is temporarily or permanently bent forward by the excurvation of the spine, the lower part of the sternum and the edges of the false ribs approximate considerably nearer to the anterior and lateral portions of the pelvis, than they do when the vertebral column is straight and retains its spinal line. As the abdominal muscles are attached by one extremity to the edges of the false ribs and the cartilago-ziphoides, and by the other extremity to the ossa pubis and spine of the ilium, it follows, that when the body is inclined forward by the curvature, the abdominal muscles are shortened and placed in a state of passive or rather semi-contraction, by which their original capacity of active contraction is diminished, and they are deprived of all the power the length of the muscles already shortened would exert; and if the body be very much bent forwards, the abdominal muscles may be shortened to nearly their full extent of contraction, so as to be almost deprived of all further contractile power. It is true, that the power thus lost cannot be accurately estimated, because there is no scale or table calculated of the different degrees of force exerted by the varied stages of the contraction of a long muscle; but it is fair to assume, that it exerts more power in the first inch of contraction than the second, &c.; hence, when a muscle is unnaturally shortened, it probably loses its most effective force. As in the state of curvature and inclination forward, above described, the abdominal muscles cannot be extended to their natural degree of elongation, to which an upright attitude is necessary, neither can they exert their usual force of contraction, because in the motion of muscles the fibres are contracted towards their middle, and the force of the contraction being in proportion to the degree of their previous extension and the length of space through which the fibres move and contract, it follows, that when the abdominal muscles are shortened, by their extremities being made to approximate, they have not the same space to move through, nor the same degree of contraction to exercise, nor consequently of force to exert, they possessed when extended to their natural length. The consequence of this muscular power is, that the abdominal muscles do not act as effectual antagonists to the diaphragm in respiration, and they do not perform those offices

assigned to them of pressing on the abdominal viscera so as to be "highly instrumental in promoting the circulation among them and in expelling the fæces and urine," as they are in health. In a case of Mr. Howship's, the abdominal muscles were so wasted, that scarcely a vestige of them was perceptible. — *Brodie on the Joints*, p. 285.

This diminished power of the abdominal muscles, from natural and mechanical causes combined, has been termed an actual paralysis by a modern author;* but although I have witnessed cases of very extensive excurvation of the spine, which have nearly implicated all the vertebræ, and have been attended with paraplegia; yet I am satisfied I have never seen a case, in which the abdominal muscles were deprived of all power of contraction and muscular motion; the reason of which appears to be, that when the diaphragm, acting as their antagonist muscle, contracts in inspiration, it impels the abdominal contents against them, by which the abdominal muscles are distended or elongated to a certain extent, which enables them to contract through that extended space to the shortened state they were previously in, when the diaphragm was in a state of relaxation, or resumes it. Where the cure by ankylosis ensues in the progress of time, and leaves a considerable excurvation and the body much inclined forwards, the abdominal muscles are permanently shortened, and accommodate themselves to the diminished space between the edges of the false ribs and pelvis, similar to what occurs to the muscles in fractures of the upper and lower extremities where the bones have been suffered to overlap each other; but the muscles thus shortened never possess a power equal to that in their original formation and dimensions: in the former case, the respiration is never perfect; in the latter, the limb is always weak.

The natural position and dimensions of the diaphragm and intercostal muscles are altered by the distortions in the form of the bony structure to which they are attached. As the fibres of the diaphragm proceed from its attachments all around the false ribs, sternum, and vertebræ, to its tendinous centre, somewhat like radii, from the circumference to the centre of a circle; when the sternum and sternal extremities of the ribs are projected forwards and the vertebral extremities drawn backwards by the successive distortions of the thorax, the depth of the chest becomes its long diameter, and the fibres of the diaphragm attached to those parts must be elongated from its anterior and posterior insertions to its middle; and as, in the oval form of the chest produced, the sides of the ribs must approximate in a lateral direction, and the breadth of the chest become its short diameter, the fibres of the diaphragm must be shortened from the sides to their centre. The intercostal muscles are also deranged and altered by the new disposition and form of the costæ, for where the latter approximate more than natural, as they

* Mr. Copeland.

frequently do in this and the lateral species of spinal curvature, so as to lie nearly or totally in contact on their posterior and lateral portions, the fibres must be shortened, and the power of the intercostal muscles to elevate the costæ must be diminished; and when the ribs are elongated so as to give an oval, instead of a circular shape to the chest, the fibres of the intercostal muscles assume an obliquity of direction different from the natural. The consequences of the altered structure and irregular disposition of the bones of the thorax, and of the unnatural dimensions and distorted positions of the respiratory muscles, are, that, in inspiration, the cavity of the chest cannot be dilated to its usual capacity in its lateral or perpendicular diameters, because the shortened intercostals cannot elevate the costæ to their usual extent, and the fibres of the diaphragm, shortened laterally, cannot depress the abdominal viscera as low as usual, and from the forward inclination of the body, the abdominal muscles, in expiration, cannot so completely contract the thorax and press the viscera so forcibly against the diaphragm, as they could do if they continued of their ordinary length. Hence it is that the respiration is so often short, irregular, or even laborious, and the second order of muscles subordinate to this function are called into action. The sternum appears to heave up and down very unusually, and great efforts are sometimes made to carry on respiration. Indeed, from the derangements all the muscles of respiration undergo, and which have the general tendency of diminishing their contractile power, both in extent and force, and from their participating in the general debility in which all the voluntary muscles are so often involved in this disease, it is not to be wondered at, that the patients become subject to dyspnœa, asthma, congestion of the lungs, and defective oxygenation of the blood, more particularly if we take into the account the deranged state of the dorsal spinal nerves to be noticed hereafter.

The muscles of the upper extremities are sometimes affected, in excurvation, with numbness, subsultus tendinum, chorea, and even convulsions, as are the muscles of the lower extremities. The muscles of the lower extremities sometimes become affected with great weakness or total paralysis, but the degree of weakness or the induction of paralysis does not appear to depend upon any particular degree of curvature, or to bear any specific relative proportion to it, for many cases of extensive curvature are not attended with paralysis, whilst some of slight curvature are accompanied by it.

The power of the sphincters of the bladder and rectum is, in some few cases, much diminished or lost, so that there is an involuntary discharge of urine and fæces.

SECT. III. — *Affections of the Bones of the Spine and Chest.*

In describing the effects of this disease on the bones of the verte-

bral column and thorax, I will consider, first, their distortion, and then the disorganization or destruction that ensues.

Taking the most simple case, in the temporary or early stages of excurvation, and when debility of the dorsal muscles is the remote cause, it sometimes happens, that there is not any existing disproportion of the bony parts of the vertebral column, and the distortion is only observable in the erect or sitting posture, and the convexity of the spine is no greater than the natural motion allows, and would not be a disease, if the natural powers could permanently remove it. In this instance, the dorsal muscles are unable to counteract the gravity of the head and vertebræ, and support them erect, so that instead of the spine maintaining a perpendicular attitude, it is bent by the superincumbent weight into a curve, whose convex side is posterior, and concave anterior, and the most projecting convexity of the curve will be formed by the vertebræ situated in the middle of the spinal pyramid. An explanation will be first attempted of the manner by which the superincumbent weight necessarily occasions the curve to project posteriorly, and, secondly, by what cause the excurvation generally takes place in the middle of the vertebral column. The first is chiefly attributable to its shape or form, the second is effected by a common law of mechanics.

The vertebral column is so constructed, that when it is placed upright, the upper or cervical part of it inclines forward, whilst the middle or dorsal, and the base or lumbar portions are nearly perpendicular: let the head be placed on the apex of this column, and it is retained in this position by muscular power, counteracting superincumbent weight. Form an elastic column of 24 joints, bearing an accurate resemblance to the human spine, without any mechanical power to counteract the effects of superincumbent weight; let the base be a fixed point, and the apex and other parts moveable ones; affix a weight equal to that of the human head to its apex, and the column must bend forward, because it must take the direction the natural inclination of the upper part of the column gives it, and, by its form, that inclination is forward; the weight superadded could not elevate the inclined or depressed portion, or bring it upright or reflect it backwards.* When the superincumbent weight has thus inclined the upper part of the column forward, suspend weights at certain distances, and angles on each side of the upper parts of the column equal to the weight of the ribs, thoracic contents, muscles, and integuments, and the column will be bent into a greater degree of curvature, the most convex part of which will be near the middle of the column, where also the centre of the greatest pressure will be; and hence it is, that, in excurvation and lateral curvature, the

* If this artificial column were placed exactly perpendicular, the weight of the head would not occasion it to deviate from that line: incline it from the perpendicular to any other direction, and it would bend the column in that direction to some given extent.

central vertebræ of the whole column form the most projecting parts of the curve or points of greatest convexity. For instance, there are 24 vertebræ, 7 cervical, 12 dorsal, 5 lumbar; consequently the 5th and 6th dorsal are the middle or central ones of the whole, and these with the 4th dorsal generally constitute the most protruding points of the curvature. Let us endeavour to explain how it occurs that the 4th dorsal vertebræ becomes the point of projection oftener than the 7th, and the attempt will also serve to show how the spinal column assumes the curvature outwards. Take an elastic conical pyramid, like the spine, whose base is a fixed point, and whose dimensions gradually diminish in size from the base to the apex; apply a weight or bending force to its apex, so as to bend it down, and an arc will be formed whose greatest convexity will project beyond the perpendicular line it had when straight; it will also be perceived, that it will bend more above its centre than it does below it, and hence it is, that in excursions of the spine, the convexity projects beyond the spinal line posteriorly, and although the 4th and 7th dorsal vertebræ are at a relative or equal distance from the middle of the spine, yet the former is oftener the centre of convexity than the latter, and the spinous processes most distantly separated are generally those of the 4th and 5th dorsal, and leave the greatest space between them, whilst anteriorly the bodies of the 4th and 5th dorsal vertebræ are those the most absorbed in excursion. It may be objected, that all analogical illustrations derived from mechanics must be imperfect, but take away the moving powers from the bones, for instance of the back, or let them be paralysed so as to be rendered unequal to their movements, and it may be asked, what does the spine present but a complicated piece of motionless mechanism. Incurvation is a very infrequent effect of superincumbent weight, because the spine does not naturally incline backwards, and because the bony bridge and spinous processes firmly resist a backward inflection, whilst the elasticity and compressibility of the intervertebral cartilages favour the inflection forwards.

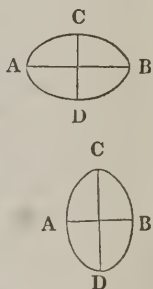
In lateral curvature, the first curve is formed by the same vertebræ as are implicated in excursion, which is to be accounted for on the same principle. — See p. 25.

From the preceding statements and illustrations it may be fairly inferred, that if the muscles of the back are, from their debility, unequal to counteract the effects of superincumbent and suspended weights,* and to sustain the vertebral column erect by the exertion of a contractile power sufficient to overcome the opposing effects of the combined weights already mentioned, then the spine must be bent by them into a curvature projecting backwards and forming an excursion. The consequence of the spine yielding to the power of these weights, is, that they must be borne by the con-

* The term "suspended weight," is somewhat new in its application, but from what has been already observed, will be sufficiently intelligible; it is the weight of the ribs, thoracic contents, &c., on the spine, when the body is bent forwards.

cave side of the curve, formed by the anterior portions of the bodies of the vertebræ, and the intervertebral cartilages, which hence become exposed to unequal and unnatural pressure. It needs no particular illustration to prove this at present, and I may be here excused for cursorily assuming that an undue pressure will be followed by an alteration in the relative and natural proportions of the bodies of the vertebræ, and that when this disproportion is once established by this or any other cause, a permanent cause of curvature will be produced. It is, however, necessary to state here, that as the relative proportions of the vertebræ are more and more diminished, the curvature increases, and, if this be effected, as most commonly happens, during the growth of the body, this state of the spine brings in its train a distortion of all the bones of the thorax. The natural form of the chest is an imperfect circle, the long diameter of which is from side to side. As the vertebral heads of the ribs are inserted into the bodies of the dorsal vertebræ, when the dorsal portion of the vertebral column projects posteriorly, the vertebral ends of the ribs must be drawn backwards, and as the sternum generally protrudes forwards in excursions of the spine, the sternal ends of the ribs are drawn forwards, by which the natural proportions of the chest are altered, and the longest diameter is from the sternum to the spine. The circular contour of the chest is reduced to an oval form; for the portion of the ribs between their heads and angles, which is naturally almost straight, becomes bent into a segment of a circle, and the parts of the ribs between the angle and the sternum, having lost their circular form, proceed obliquely forwards, so that their new shape gives the appearance of flatness to the sides of the thorax, and the sternum protrudes like the keel of a ship or the breast of a fowl, and the patient is said to be chicken-chested. These deviations of structure are easily illustrated:

— Take a piece of whalebone of a nearly circular figure, suppose A B to be the sides, and C D to be the spine and sternum; apply a force to draw out or elongate the whalebone at C D, and the sides A B must approach nearer to each other, thus: and become more or less flattened.* The distance from C to D intended to represent the distance from the sternum to the vertebræ becomes the long diameter. All this, then, is the pure mechanical effect of change of structural arrangement, and the effects it produces on the muscles of respiration has been explained as far as is necessary for the purposes of this dissertation. Some of the dorsal vertebræ are situated between the scapulæ, and fall gracefully inwards between them, when the form is natural, but when the distortions of the spine and chest above described are induced, the dorsal vertebræ protrude backwards between and be-



* See Glisson's *Tractatus de Rachitide*, p. 132. Ed. 2da.

yond the scapulæ, and the scapulæ are thrown forward or more laterally, on the sides of the costæ, and make the shoulders appear round. It might have been previously mentioned, that when the curvature is extensive and the back very weak, a slight lateral curvature is sometimes superadded to the excurvation, which in these cases sometimes becomes double; the lateral curvature in this instance seems to arise from the patient seeking to rest or support himself, when sitting or standing, by leaning to one side, after he finds himself weary or fatigued from inclining forward. When the double excurvation occurs, the first curve is formed by the dorsal vertebræ, and the second, which is always very slight, by the lumbar vertebræ. — Having described the distortion of the bones, it seems in natural order to proceed to a consideration of their destruction.

The destruction of the vertebræ of the spine is accomplished by two different modes of action, which after death present dissimilar appearances. One mode is by the induction of caries or ulcerative absorption; the other is by progressive absorption. The bodies of the vertebræ are almost exclusively subject to the effects of these two modes of destructive action, and of course the bony bridge and processes seldom suffer from either, but they nevertheless undergo changes which are commonly of a different character. The intervertebral cartilages are also destroyed by ulceration and progressive absorption. Caries of the bodies of the vertebræ is, in general, the result of that slow scrofulous inflammation, which peculiarly invades the cancellous structure of these, and the articulating extremities of other bones, in which case the remaining portions of the bodies of the diseased vertebræ are often soft, and may be easily divided with a common knife. At first, this inflammation produces an appearance of increased vascularity in the bone; ulceration soon follows; the earthy matter becomes absorbed, and the bone is thereby rendered soft and spongy; at length the secretions in the cancelli become also absorbed, and a deposition of a caseous, or thick, curdy, matter, often yellow, fills its place. Caries also ensues from chronic common inflammation; in which case, the portions of the vertebræ contiguous to the carious part are unusually vascular, and of a dark colour; but they preserve their natural texture and hardness. I am informed by an eminent surgeon of this metropolis,* that he has dissected two curved spines, in which the bone remained hard, but was so brittle, that pieces might be struck off in splinters with the greatest facility. Caries may take its origin in any portion of the circumference of the bodies of the vertebræ, or on their horizontal surfaces; in the latter case, the ulceration sometimes spreads from the intervertebral cartilages to the bony surfaces in contact with them. The bodies of the vertebræ are destroyed in the most irregular manner, and the drawings of different specimens to be found in the works of Mr. Ford,† and more modern authors; the prepara-

* Mr. Brodie.

† On the Hip-joint.

tions in the different museums, and dissections amply display these irregularities. Sometimes excavations are formed through the body, sometimes the caries destroys the perpendicular, sometimes the horizontal surfaces on the anterior portions or the sides, sometimes the destruction is more regular and leaves a surface tolerably smooth, more commonly the carious vertebræ are jagged, fissured, irregular, and full of cavities, filled with purulent and curd-like matter, &c. Caries of the vertebræ is sometimes called dry, that is, the bone is destroyed without producing pus.

Caries of the vertebræ very often gives rise to inflammation of the soft parts around and contiguous to them, which terminates in suppuration. Hence, abscesses are formed, which first collect opposite the carious vertebræ; — if these should be the dorsal, the abscess will collect in the posterior mediastinum, and the pus may separate the pleura from its natural adhesions, and by pressing on the lungs occasion inflammation of the pleura, and distressing dyspnoea; or it may burst into the thorax and occasion death. If the lower dorsal or lumbar vertebræ be the seat of caries, the collection of pus may insinuate itself between the crura of the diaphragm, may separate the peritoneum from the diaphragm or its other natural adhesions, or it may penetrate through the peritoneum among the intestines, and excite peritonitis that may terminate in death. The collections of pus, even when as high as the upper part of the posterior mediastinum, sometimes gradually insinuate themselves along the spine, and present anteriorly in the course of the psoæ muscles or of the spermatic cord, or these abscesses may take an outward direction, and break posteriorly on one side or the other of the vertebræ, so as to become what are strictly denominated lumbar abscesses.

These abscesses now and then take a course to the verge of the anus. They also have been found to penetrate through the theca vertebralis and insinuate themselves in the course of the medulla spinalis. Abscess, formed among the psoæ muscles, sometimes produces caries of the spine; hence, these two affections reciprocally produce each other: — Yet caries of the vertebræ does not necessarily produce psoas abscess, nor do lumbar abscesses necessarily produce carious vertebræ. It has been already observed, that caries of the spine is occasionally communicated from a diseased and ulcerated intervertebral cartilage; caries of the vertebræ, however, much oftener propagates the ulcerative absorption to the intervertebral substance. When the ulcerative absorption of the bony parts of the spine is occasioned by the pressure of tumours, the bone is frequently absorbed, whilst the cartilage remains entire, or is but very little affected, so that it appears to imbed itself in the substance of the tumour. When two or more vertebræ are entirely removed by ulcerative absorption from any other cause but the pressure of tumours, the intervertebral substance has been destroyed to the same extent in the cases that have come under my experience, and have been subsequently submitted to dissection.

The destruction of the bodies of the vertebræ by progressive absorption is effected in a different manner from that by caries or ulcerative absorption. Progressive absorption is always begun and continued on their horizontal surfaces, and proceeds in an oblique direction from the anterior to the posterior parts of their bodies, so that if the disease be suffered to run its course without interruption, the bodies of the vertebræ are first reduced to a cuneiform shape, and are then rendered thinner and thinner, until they are wholly absorbed, and as this process is, in general, the consequence of unnatural pressure, the intervertebral cartilage becomes absorbed previously or contemporaneously with the bone. By this process, I have seen, on dissection, the bodies of five vertebræ entirely destroyed, and that of another partly absorbed. I have also seen the whole of the dorsal vertebræ and intervertebral cartilages reduced more or less into the cuneiform shape by this process, without the integrity of the joints being done away with. In instances of more limited disease of this nature, only two or four vertebræ are reduced to this shape. No abscesses form in cases of disorganization from the action of the absorbents. In such, it is probable, the bone is less solid than natural, or its organization so imperfect as to render it liable to absorption.

The form and extent of the curvature differ in the proportion of the number of the bodies of the vertebræ destroyed, either by ulcerative or progressive absorption, or of the quantity of their horizontal surfaces removed by either of those modes of action. When only two vertebræ are destroyed, the most projecting parts of the curve protrude more directly like the extremes of the long diameter of an ellipsis. When four are destroyed, the curve assumes a form more like the extremes of the long diameter of an oval figure. When the bodies of many vertebræ are destroyed, or the anterior portions of many are reduced into the shape of wedges very obliquely graduated, the arc formed is more regular and circular, and the surfaces of the remaining healthy vertebræ above and below approximate closely, so that the distance between them, where four or five bodies have been destroyed, will be only a few lines. See Miss J. A.'s case. If the cord line of the curve be measured, it will enable us to form some estimate of the quantum of destruction that has taken place, and to guess how many of the vertebræ are destroyed or how much of the horizontal surfaces has been removed. The thickness of the bodies of the vertebræ differs according to age and the different periods of growth; they also vary with the short or long stature of each patient, so that no precise rules or estimate on the subject can be laid down; but if all the dorsal vertebræ be not involved, the cord line of those implicated in the curvature can be compared with the length of those remaining healthy, and where all are involved, the cord line may be compared with any estimate that may be made of the ordinary length of such a number of vertebræ in a person of the same age and stature. When the bodies

of many vertebræ are destroyed, the cord line of the curve is generally of short dimensions. When many of the vertebræ are reduced into a cuneiform shape the arc is very regular and the cord line short; but in those cases, where the integrity of the joints is preserved, it sometimes happens that the most projecting vertebræ protrude backwards even two inches beyond the spinal line, and the curve assumes or is formed of an oval shape by the bodies of the vertebræ approximating closely at the posterior part of the curve, and gradually diverging as they advance anteriorly, as in Miss Bennett's case. Hence, in such cases, there is no cord line to assist the judgment in determining the quantum of destruction.

It is stated by most authors, and the language has been adopted in this dissertation, that the bodies of several vertebræ are "entirely" or wholly destroyed; but this is not strictly correct in the general and precise sense of such language, for, by some wise arrangement of our preservative powers, which cannot be comprehended or explained, although we can perceive and admire them, it is ordained by the all-wise and merciful Creator, that parts, which enclose and defend organs or structures highly essential to life, possess either a higher vitality, or are endowed with a stronger capacity or powers of resisting diseased actions and their effects, than those of similar structure which discharge no such important purpose. We could not but premise this observation to the fact, however it may be explained by others, that the posterior surfaces of the bodies of the vertebræ, which form the anterior part of the spinal canal, are almost always the last portions that yield to, or are destroyed by, ulcerative or progressive absorption, and generally escape so far as to leave a bony continuity to that part of the canal; whilst we have not yet witnessed an instance of the posterior part of the spinal conduit formed by the processes, being wholly absorbed, or even of its continuity being destroyed, although the structure has been much altered and nature (as it were) reduced to the necessity of uniting several spinous processes, by ankylosis, to maintain a bony continuity of the canal, and ensure a competent, or even moderate defence to the medulla spinalis. In such cases, there is sometimes an ankylosis of the transverse processes. When any part of the spinal column is reduced to the state just described, so that the processes and bony parts immediately enclosing the medulla spinalis only remain, the following case induces me to believe, that fracture of the spine is easily induced. Miss Ward, 5, North Street, Manchester Square, æt. 7, had been long afflicted with excurvation of the spine, apparently proceeding from scrofulous caries, for the cure of which her father would not allow either the recumbent posture or issues to be employed, or, in fact, any regular remedies to be used. She gradually lost the use of her lower limbs, and, in the day time, generally sat in an armed chair, with her elbows placed on the arms of it, and her head resting on her hands. On the 21st of October, 1822, she

was lifted out of bed, and, by some accident, was allowed to fall from the arms of the servant to the ground on her back, and, after screaming, died in five minutes. The father opposed the wishes of the mother and myself to perform necrotomy, and I was obliged to abandon it, but it seemed probable, from the mother's statement and belief, that the spine was fractured by the fall, at the most projecting point.

The ribs become deranged in form and structure in proportion to the extent of excurvation, as has been partly described. When the curvature is great, the posterior parts of the ribs are placed in closer apposition than natural, and sometimes touch each other, by which the intercostal muscles in this part of the chest are contracted and shortened and sometimes almost obliterated. I have seen those portions of the ribs partly destroyed by absorption, and sometimes by caries; in the latter case, the remains of some of them have been found soft, like other bones affected with scrofulous caries. In excurvation, the sternum generally projects forwards, and I have, in some cases, seen the lower portion of the 2d division of the sternum project outwards, and the cartilago-ensiformis turned inwards, so that the whole presented the form of a cracked or half-broken bow, at the point of union of the second portion of the sternum with the xiphoid cartilage. Mr. Brodie relates, that in a case of curvature from scrofulous caries, "four of the ribs were separated from their attachment to the spine, and were ulcerated as far as the tubercles;" "the ribs were porous, and their cancelli were filled with a curdly matter; and they were so soft they might be easily divided with a common scalpel." — *On the Joints*, p. 297.

Some instances of incipient excurvation are accompanied with a distressing malformation of the true ribs. In a few cases which Dr. Granville has had the kindness to send to me; and in others which have occurred in my own practice, the costæ veræ, instead of taking the circular contour outwards, are curved inwards on the sides of the thorax, from their posterior part that advances forwards to where they are joined to their cartilaginous extremities. They apparently press on the lungs and heart, and occasion constant dyspnœa, frequently attended with cough, and painful respiration in the usual recumbent posture. The right side of the chest is generally more malformed than the left, but the false ribs are seldom implicated. This malformation most frequently occurs in children. As yet, no parent has admitted the malformation to be congenital; it may, therefore, be inferred to be an error of after-growth. It seems doubtful, whether it be caused by the development of the lungs being so defective as not to dilate the ribs to their ordinary extent, or by an unnatural growth of bone determining the ribs to curve inwards and press on the thoracic contents.

SECT. IV. — *Affections of the Spinal Canal, Medulla Spinalis, and Nerves.*

The spinal canal and spinal marrow suffer some deviations from their natural conformation and relative proportions.

The spinal canal being placed in the centre of the vertebral column naturally follows the disposition of the vertebræ, and takes the position they are obliged to assume; when, therefore, the spine is curved temporarily or permanently, the canal must describe a circular turn corresponding to the curve, and this is the only difference in respect to position. If the curvature be formed during the growth of the body, the calibre of the spinal canal becomes contracted in size, or smaller in its continuation through the curved vertebræ than it is either above or below the excurvation. The canal very generally remains smooth and continuous, and its integrity is preserved, that is, the spinal canal is not rendered unequal or uneven by the edge or surface of any vertebra being protruded into the canal, so as to press on the medulla spinalis, but all the bones forming it are, in general, held firmly together in their proper and relative situations, agreeably to their new position or line of curve, and do not exhibit the slightest appearance of dislocation or subluxation. By such wonderful powers does the Creator protect and preserve vital parts.* • When the spinous processes are, however, much separated from each other, the posterior part of the spinal canal is sometimes not formed of, or protected by bone for a time, and the medulla spinalis is very close to the common integuments; in such cases, the interspinous ligaments become gradually converted into cartilage and bone, and an ossification, producing anchylosis of the spinous processes, ensues, which secures the medulla spinalis from pressure and injury. If the curvature occur during the growth of the body, as most commonly happens, the diseased action, or partial destruction of the bodies of the vertebræ, and the unnatural situation the spine is thrown into, in all probability, tend to diminish or arrest the growth of the diseased bones, and consequently of the part of the spinal canal passing through them, and its regularly diminished calibre bears the appearance of the growth having ceased before the canal had arrived at its proper dimensions. When the excurva-

* In Gibbo enim unam aliquam vertebam sublimem foras eminere necesse est, eas verò quæ hinc et inde sunt minùs. Neque ea tamen a reliquis multum desilit, sed paulum, cum singulæ in universum cedant. Eam igitur ob causam etiam dorsalis medulla ejusmodi perversiones ubi in circulum, non in angulum pervertitur, facile tolerat. — *Hippocrates, Sect. 23, de Articul.*

Among the posthumous papers of the lamented Dr. Baillie, was found the drawing of a distorted spine, which seems to be an exception to the last observation, in which the spinal canal is, at one part, so much encroached upon by the projection of the bodies of the vertebræ, that it is scarcely half its natural size; the spinal marrow, consequently, appears compressed or diminished." — *Appendix to Mr. Shaw's Work on Lateral Curvatures.* In this case, there was no paraplegia. See, also, *Ollivier*, p. 201.

tion has arisen in an adult, whose growth has been completed, this diminished calibre of the spinal canal has not appeared in the spines I have been enabled to examine. The foramina on the sides of the vertebræ, for the passage of the spinal nerves necessarily take the situation of the vertebræ in which they are formed, and are thus thrown backwards more than in the natural condition of the spine; but I have never seen one obliterated or destroyed, although they have been slightly diminished in size, like the part of the canal with which they communicate. The curvature of the vertebræ and diminished calibre of the spinal canal must necessarily affect the spinal cord, first as the medulla spinalis must be drawn into the same curved form as the canal which contains it; and, secondly, the dimensions of the medulla must be proportioned to the size of the various parts of the canal through which it passes, and, consequently, must be diminished where the canal is contracted. In the natural state of the vertebræ, the fibres of the medulla spinalis are of equal length, but it will be evident that, in permanent curvatures of the vertebræ, their relative strength must be altered, as the fibres on the convex side of the curve must make a longer course than those on the concave side. I am not aware, that the recent and splendid discoveries of Mr. Chas. Bell, which so satisfactorily explain the properties of the spinal nerves, will account for the anomalous symptoms that occur in spinal curvatures. From them, the parts they supply derive motion and sensation; the anterior, or cerebral origin conducting to motion, and the posterior, or cerebellum origin, to sensation. Where the spinal cord is of diminished dimensions, it would seem that both the brainular columns, constituting the spinal marrow,* are contracted in size, and that one portion is not

• By the language in ordinary use I have adopted, I would not be understood to convey an idea that the medulla spinalis takes its origin, or grows from the brain, like a plant from its bulb, or that the nerves shoot out from the sides of the spinal marrow, like the branches of trees and plants from their stems; because such a doctrine necessarily implies a long priority of existence of the brain to the spinal marrow, and of the spinal marrow to the nerves, constituting three orders of successive growth in the organization of one system; for it is more consistent with just and respectful notions of creative wisdom, to consider that the whole nervous system is not produced by a successive growth of one portion or division from and after the other in regular progression, but that all the parts are formed, independently of each other's existence, in the structures they respectively occupy, by the organs or vessels appointed for the purpose by the Creator, and their development and organization perfected at periods of time in the growth of the infant in utero, his laws have established. Those who have made the minutest researches on embryogeny, state, that as soon as any thing can be distinctly discovered of the nervous system, the cavities of the brain and spinal canal are filled with the same elementary rudiments, which consist of a fluid of a greyish-white colour, from which the various contents of the cranium and spinal marrow are developed, but how and when the most learned and laborious anatomists widely differ. It would also seem more consistent with strict precision of language, to describe the nerves as forming an union or junction with particular parts of the brain, or of the medulla spinalis, than to state, that they take their origin from them; for spinal marrow and nerves have been found in acephalous infants, and nerves have been

decreased in any particular degree. I have already remarked, that the foramina, through which the spinal nerves pass, are never obliterated, although slightly diminished in some cases, so that, in fact, a single pair of nerves is never lost, in excurvation of the spine, to the parts they supply; but after they have passed out, their course is longer to the viscera in the ratio, that the part of the spine from which they proceed projects backwards beyond the spinal line.

If the energy and power of the nerves depend upon the medulla spinalis, from which they take their origin, being formed of its natural size and quantity, it would seem a natural inference, that they cannot be possessed of their proper degree in cases where its due growth has been obstructed and prevented. If the natural size of the nerves depend upon the spinal marrow being of its natural dimensions, where they are united to it, it follows, that they must be smaller, when the medulla spinalis is contracted in dimensions. If, also, their energy and power depend upon the pairs of nerves issuing from the curved parts, taking their direct and natural course to the organs, and parts to which they are distributed, part of it may be inferred to be lost by the indirect courses the altered structure of the vertebræ obliges them to assume. These inferences appear rational, and it is highly probable that the nerves, issuing from the diminished portions of the medulla spinalis and spinal canal, are deprived of part of their nervous power and influence, as well as the organs and parts they supply, especially of the share they contribute to due nutrition, secretion and growth, for the distorted are generally stunted in growth and impaired in strength, and thus persons affected with permanent excurvations are generally short in stature, and, in lateral curvatures, the growth of the half of the body is often more fully developed on the convex side of the curve, and is of larger dimensions than the half of the body on the concave side. The tortuous course of the spinal cord, the compressed appearance and diminished size of a part of its length, and the longer course of the nerves, which are joined to this curved and projecting portion of it, do not uniformly produce similar effects on the system; nor does the degree of nervous power lost necessarily depend upon the extent of the curvature: for a patient with a very small degree of curvature and with but little vertebral pain, may be affected with paralysis of the lower limbs, with general weakness and a torpor of the digestive and urinary organs, whilst another, who has had several bodies of the vertebræ destroyed, and whose dissection has disclosed a contracted spinal canal and cord, shall have been enabled to walk about to the last hour, and shall have preserved the animal functions in a state but little impaired. Yet it appears to be quite

formed where there was no perfect trace of spinal marrow. The labours of Tiedemann only prove that the various parts of the brain are not perfected at the same point of time from the same elementary fluid.

certain, that many of the symptoms which supervene in this complaint must be attributed to the derangements of the spinal cord and nerves occasioned by the curvature. To refer to this cause only some which affect the nervous system, I might mention headache, fits, and every loss of sensation of parts or of muscular motion. The disordered respiration is also partly owing to the same cause. I have been induced to believe, too, that inflammation and curvature of the spine predispose to inflammation of the brain, for in the year 1822, three patients who had been under my care for diseases of the spine, were attacked with phrenitis and died. The first, a boy, after having been cured of spinal inflammation; the second, a girl, during her treatment for the angular projection of the spine; and the third, a girl, after having been cured of excurvation of the spine, and sent into the country. Many affected with curvatures are subject to a variety of nervous complaints. Dissections have disclosed the trunk of the intercostal or great sympathetic nerve, to be either shortened in proportion to the length of the body diminished by the destruction of the bodies of the vertebræ or by the curvature of the spine, or bent into a circuitous course, and it is probable its shortened dimensions or tortuous course impair the power of the nerves derived from it.

The interruption or destruction of the continuity of the spinal marrow in excurvation or other curvatures is not a frequent occurrence; three cases have, however, been recently related, one by Dr. Rullier, in Mageudie's Journal, in which the spinal marrow was converted into a fluid along the space of the two inferior thirds of the cervical portion and the upper third of the dorsal, and two by Dr. Ollivier.* In a child of 8 or 9 years, a complete deficiency of spinal marrow existed from the 9th dorsal to the 1st lumbar, that is, about four inches. In the other, a girl of 13 years, at the lower part of the dorsal region, the nervous pulp, reduced to a putrid state, was converted into a pultaceous matter, and deficient for four or five lines. In the latter cases, the vertebræ were affected with scrofulous caries. It is a most remarkable circumstance, that, in all those cases, there was not paralysis of the lower extremities.

SECT. V. — *Affections of the Ligaments of the Spine.*

The ligaments of the spine are numerous, strong, and inelastic, and well calculated to hold the bones firmly together, yet they undergo morbid changes in this disease. Dissection has displayed the ligamentum anticum commune, and the ligamenta intervertebralia in the various stages of inflammation and ulceration, and in different degrees of destruction, whilst the ligamentum posticum

* See Obs. v., p. 143, and Obs. xlix., p. 339. De la Moelle Epinière et de ses Maladies, par C. P. Ollivier, D'Angers. — Paris, 1821.

commune, the ligamenta interspinosa, intertransversalia and capsularia, very frequently escape from those diseased actions, and continue to retain the posterior portions of the vertebræ together, and secure them from dislocation and fracture. Inflammation of the anterior ligaments occasions them to present an increase of thickness and vascularity. Inflammation does primarily originate in those ligaments, although it occurs but rarely, for it is most commonly propagated from, or excited by the diseased or carious state of the bodies of the vertebræ and intervertebral substance. In either case, it generally terminates in ulceration, by which the ligaments are often irregularly destroyed as far as the boundaries of the caries extend. Sometimes the ligaments are not destroyed by ulceration in cases of caries, but, on being cut through, discover a mass of serofulous or carious matter, occupying the place of the bodies of the carious vertebræ and intervertebral cartilage; or they are thickened, softened, and have lost their firmness. When the curvature is slight and incipient, I have found, on dissection, the ligaments in their healthy, natural state, free from inflammation or ulceration. In more extended curvatures, the ligaments, although inelastic, are tense, stretched, and elongated on the convex side of the curve, and contracted or shortened on the concave side, in a ratio corresponding with the diminished thickness of the vertebræ involved in the curvature. When the bodies of some vertebræ and their intervertebral substances are wholly destroyed by progressive absorption, and the anterior ligaments have escaped uninjured, the remaining connecting ligaments, that extend from the vertebræ above to those below, are shortened on the concave side of the curve, and lie loose when the spine is most bent, and then the ligaments on the outer line of curve are stretched and tense. When the bodies of the vertebræ have been wholly destroyed by progressive absorption, I have seen the anterior ligaments much thickened and partly ossified, and covered with fat. Thus, in this absorbent destruction, the ligamentum anticum commune is preserved entire; whilst, in the ulcerative or carious destruction, it has been already remarked, that this ligament is often destroyed, a circumstance evincing some difference in the nature of the two affections. When spinal excurvation terminates in ankylosis, I have seen the anterior and posterior ligaments in their progressive stages of conversion into cartilage and bone, and specimens of the bony conversion may be found in the different museums of morbid anatomy, differing very much in their appearance. The subject of relaxation of the vertebral ligaments, on which there has been considerable collision of opinion of late, will be more properly discussed, when the consideration of the causes of curvatures are investigated. At present, it will be sufficient to observe, that I have described the only relaxed states of the ligaments I have witnessed on dissection, but it may be added, that the remains of ligament destroyed by ulceration are left in a loose or relaxed state. The "fibro-ligamentous," or intervertebral sub-

stance, is occasionally and primarily attacked with inflammation and consequent thickening and increased vascularity, followed by ulceration spreading from the centre to the circumference. These actions are generally secondary effects proceeding from caries of the vertebræ; but, when primary they ultimately affect the bodies of the vertebræ with caries, and the swollen intervertebral substance from chronic inflammation, by slow degrees, sometimes occasions pressure on the medulla spinalis, by protruding the posterior spinal ligament into the canal, on the medulla. — See *Brodie on Diseases of the Joints, Copeland on Spinal Diseases, and two cases, in chap. ix., sect. v. of this Essay.* Another cause of the slow compression of the spinal marrow proceeds from the swelling, which is sometimes considerable, of the intervertebral cartilages, dependent apparently on a scrofulous affection. It is often met with in the dorsal disease of Pott. We find, on these occasions, a knob, projecting transversely into the spinal cavity, which has thrust out of its place the posterior common cervical ligament, itself softened at this part.—*Ollivier, de la Moelle Epiniere, p. 213.*

SECT. VI. — *Affections of the Arterial and Absorbent Systems.*

The morbid dissections of Morgagni, Lieutaud, Haller, and others, furnish accounts of some changes and derangements of the bloodvessels that run along the course of the spine. In some cases, aneurism has been discovered, but the pressure of aneurismal sacs frequently produces ulcerative absorption or caries, without producing curvation. In others, the large bloodvessels, both arteries and veins, have been drawn into the circuitous course of the spine on its inner line of curve,* by which and the preceding cause, the blood is deprived of its naturally ready and easy flow to the parts and organs below the curve, and more may consequently be sent to the head, and there occasion apoplexy, headache, or even inflammation of the brain. In the cases where several bodies of the vertebræ are destroyed by progressive or ulcerative absorption, and the length of the spine is thereby decreased; in the proportion of the number of vertebræ destroyed, and of the approximation of the remaining sound ones, the aorta descendens and venæ cavæ must be either removed at a distance from their natural situations, and take a serpentine course; or if the change occur during the growth of the body, as so generally happens, these bloodvessels may be shortened in their natural longitudinal dimensions, and, by accommodating their length to the lessened

* In Mr. C. Bell's Museum, there is also a specimen of carious spine in a young person, which has terminated in partial ankylosis. The aorta has accommodated itself to the course of the spine, but the œsophagus, on the contrary, runs direct from the neck to the diaphragm. so that it is not more than 3 inches long, whilst the aorta measures between the same points nearly 9 inches.— See *Mr. Shaw's Appendix, p. 285.*

length of the spine, may preserve a straight course. In either instance, the organs and parts of the body that derive their blood from them may be deprived of their natural supply and healthy quantity of blood, and become defective in growth and function.

The œsophagus, thoracic duct, and great intercostal, are liable to the same consequences as the bloodvessels. Morgagni observes, "that a perverted situation of the viscera and vessels of the belly is a consequence of spinal distortion, and that we may conjecture how much, of course, not only the smaller vessels, among which is, in particular, the thoracic duct, but also the greater part of the nerves and other parts of the like kind, must have been disturbed from their natural situations."

When the distortion of the spine has produced the oval conformation of the chest, the heart and its bloodvessels are removed at a greater distance from the spine than natural, and the heart may be compressed a little in its anterior position. The circulation is consequently often deranged, and the heart, in some instances, becomes subject to palpitation, which frequently gives rise to an erroneous suspicion of the existence of organic disease of the heart.

SECT. VII. — *Some of the Affections of the Thoracic and Abdominal Viscera, and the Urinary Organs.*

When the distortion and vertebral destruction are considerable, the relative situations of some of the viscera of the thorax and abdomen must be perverted, and their position and dimensions deranged or altered. By the distorted and unnatural arrangement of the costæ and sternum which takes place in excurvation of the dorsal vertebræ, the distance between the vertebræ and the sternum is increased, and becomes the long diameter of the chest; and the distance from one side to the other is decreased and changed to the short diameter: as this generally occurs during the growth of the body, the form of the lungs is proportionately altered and modelled to the conformation of the thorax, and are thereby compressed on their sides, and extended or dilated from the vertebræ to the sternum. This necessary result is, however, inimical to free respiration and due oxygenation of the blood; in many instances, patients or persons, with this affection, are frequently subject to dyspnœa or asthma, accompanied with a livid colour of the lips, cheeks, nails and fingers, and some swelling of the hands and feet, that are usually cold, together with a sense of constriction of the chest, and inability to respire, except with the body in an attitude nearly perpendicular. In the dissection of two patients who have died from attacks of asthma, during their treatment for excurvation of the spine, the lungs have been gorged with black blood, and, on being cut into, presented a mass more like dark coagulated blood than the parenchyma of the lungs. The pleura

pulmonalis was also adhering to the pleura costalis. In other cases, the patients have been strongly predisposed and subject to frequent attacks of pulmonary inflammation, bronchitis and cough; and sometimes asthma and pneumonia have been combined. Tubercles and vomicæ are sometimes found in the lungs, and vertebral abscesses have broken through the pleura costalis, and occasioned a miserable death. Abscesses are occasionally found in the posterior mediastinum,

From the length of the spine being shortened by the curvature (and consequently of the body properly so called), the thoracic viscera are detrudded on the diaphragm, which presses down the liver and abdominal contents against the abdominal parietes, by which the belly is often made to assume the appearance of protuberance in this complaint, and the margins of the false ribs to be pressed upwards: if these changes occur during the growth of the body, nature endeavours to accommodate the viscera to their novel situations, and the lessened capacities of the cavities they occupy, by proportioning the future growth of the viscera to the reduced dimensions of the chest and abdomen; but, in adults, the effects must remain permanent.

The upper surface of the diaphragm is occasionally ulcerated by the pressure of pus lodging there after having escaped from a vertebral abscess. — *Lloyd on Scrofula*, p. 231.

The stomach is very often affected with indigestion, loss of appetite or a capricious one; there is also a sense of constrictive tightness or pain across the epigastrium, especially at night, referred to the morbid condition of the nerves of the stomach. The bowels are frequently costive and require the aid of purgative medicines. In other cases, even where dissection has subsequently disclosed several bodies of the vertebræ destroyed, the digestive functions of the stomach and the action of the bowels have been preserved as regularly as when the patient has been in rude health. In some instances, that are rare, the sphincter ani has been affected with paralysis, and an involuntary discharge of fæces has taken place.

Part of the liver is sometimes detrudded below the edges of the false ribs from the new situation of internal parts. Its secretory functions are sometimes impaired and become torpid, so that the fæces are clay-coloured or muddy. Tubercles have also been found in the liver.

The kidneys and bladder are sometimes morbidly affected. Thus I have seen the urine both clear and cloudy, and depositing both the white and the lateritious sediments. The sphincter vesicæ is sometimes affected with paralysis, giving rise to incontinence of urine.

When the perversion of the natural situations of the viscera, of the great bloodvessels, of the ganglionic system of nerves, and of the thoracic duct is contemplated; when the structural altera-

tions and deviations* of the lungs, heart, liver, and some other of the viscera, aorta descendens, venæ cavæ, thoracic duct and some of the nerves are considered ; when the derangements of the spinal cord and the spinal nerves, of the abdominal and intercostal muscles and diaphragm, and the curvature and shortened spine are weighed ; when we view the spinal marrow, thus deranged, as the principal seat of sensation and motion, and know the spinal nerves are distributed to all the viscera contained within the thorax, abdomen, and pelvis, and supply them with the nervous energy necessary to their important functions, as well as to the muscles of the upper and lower extremities, back, chest, diaphragm, and all the other constituent parts, besides possessing a connexion with the nerves of the brain through the ramifications of the great sympathetic ; when we reflect on the aggregate of disorder and displacement of the frame-work and the frame, we cannot be astonished at hearing an appalling catalogue of maladies which are attendants or consequences of spinal deformity and disease. A catalogue, whose history and treatment to pursue and dwell upon in this dissertation would make it almost endless ; for I have known the head affected with severe pain, occasionally predisposing to phrenitis and death ; the eyes affected with convulsions, and imperfect vision ; the ears with deficient hearing ; and I have witnessed, as companions to curvatures of the spine, dyspnœa, asthma, congestion, and inflammation of the lungs ; imperfect oxygenation of the blood ; palpitation of the heart ; aneurisms of the aorta ; a corded tightness across the epigastre ; gastrodynia ; indigestion ; loss of appetite or a vitiated state of it ; torpor of the liver, or deficient secretion of bile ; constipation ; discoloured fæces ; morbid secretions of the kidneys ; involuntary discharge of urine and fæces ; a variety of nervous feelings ; epileptic fits ; numbness and coldness of the extremities ; tic-douloureux-like pains about the joints of the lower extremities and muscles, and of the posterior part of the ileum ; paralysis of the upper and lower extremities, and an almost universal torpor. When all these circumstances and symptoms are maturely deliberated upon, we cannot be surprised that the functions of the various organs, muscles and vessels, are disordered ; we should rather be lost in admiration at the resources of nature, which enable some patients to endure many of them without much expression of suffering, during the gradual progress of the morbid changes, and which resources finally accommodate the viscera to the new state of structure, and enable them to carry on their offices so well, that some such deformed patients eventually enjoy a good share of health and animal spirits, and mental energy and bodily strength, during life, and are only unlike their fellow creatures in their deviations from the beautiful symmetry of structure, the fair and admirable form, and matchless proportions, designed by the benevolent and wise *Creator of all*.

* Of position

It may be observed here, that excurvation of the cervical vertebræ exhibits one or two peculiarities that may be noticed.

When this part of the spine is curved outwards, the patient often feels both inability and disinclination to maintain the head erect, and seeks to repose it on a table or any thing before him; in this case, also, it has happened, that the upper extremities become affected with "numbness and loss of voluntary motion,"* a circumstance which, Mr. Pott states, "he has never once seen," and there are pain and difficulty in the rotation and movements of the head, and the oppressed breathing will be one of the most strongly marked features. — *Copeland*, p. 31.

In my patient, Mr. Charles Lawrence of Bow Street, there was an excurvation of the three lower cervical and two upper dorsal vertebræ, besides a slight lateral curvature to the right formed by the lower dorsal and lumbar vertebræ.^a In this case, a malformation of some of the spinous processes was remarkable. Besides being unusually large, that of the sixth cervical was directed to the left side, the spinous process of the seventh was directed to the right side, and that of the first dorsal to the left of the proper spinal line. The dyspnœa was only occasional, and his arms retained their muscular power.

CHAPTER III.

REMOTE AND IMMEDIATE CAUSES OF CURVATURES OF THE SPINE, AND PREDISPOSITIONS.

SINCE the days of the celebrated Mr. Pott, there have been laid down by authors, even the most recent, two positions as established, relative to spinal disease:—1st, that, wherever there is curvature of the spine, there must be caries: and, 2dly, wherever there is caries, there must have existed scrofulous action in the bodies of the vertebræ, as the sole cause of disease. These positions are so untenable, that surprise is naturally excited at their having been so long acceded to, without a strict investigation of their correctness, for the truth is, curvatures without caries are of more frequent occurrence than those with caries, and the causes of distor-

* [Dr. Usher Parsons has seen, in a few cases, incurvation as a consequence and compensatory result of excurvation; and Guérin observes, that all the cases of lateral curvature show two, three, or even four curves alternating; nearly always three, seldom two, and never one alone. — Ed.]

* See Mr. Wilson, on the Bones, p. 405. Lloyd on Scrofula, p. 218.

tions of the spine being numerous, may, with advantage, be divided into remote and proximate.

SECT. I. — *Remote Causes.*

Contusions and shocks from falls, sprains of the vertebral joints, scrofula, rachitis, syphilis, rheumatism, careless and habitual malpositions of the body, particularly during its growth; malformation or irregular and unnatural growth of bone; cerebral affections; muscular debility, and old age, may be enumerated among the remote causes; and, of these, contusions, and shocks from falling, have obtained a sort of popular belief of their being common causes, for most parents trace the origin of their children's distortions to nurses, or some other persons, having allowed them to fall.

Partial or total paralysis of the muscles of the back will produce temporary distortion, that can be at all times removed by mechanical means, as long as the vertebræ preserve their natural and regular dimensions.

It will be of use here, whilst treating of the remote causes, to endeavour to trace the connexion between them and the proximate causes, and to investigate how far the latter are capable of occasioning or leading to distortion; which, perhaps, must be finally inferred to be a pure mechanical effect. Hence it may be proper to observe, although it may occasion repetition, that it may be assumed at present, the proximate causes of permanent curvature are caries or ulcerative absorption of the vertebræ and intervertebral substances; progressive absorption of these; or an unnatural or rickety growth of the vertebræ; all of which destroy the just proportions of the structural parts of the spinal column.

As so many parents attribute the origin of spinal distortions to contusions on the back, from having observed them to be induced soon after such unfortunate accidents, it seems feasible that such occurrences may produce a morbid enlargement, or a morbid destruction of the bony structures of the vertebræ, by implanting in them a disposition to increased growth and morbid organization, or to inflammation and caries, in the same manner that experience has shown such consequences to follow contusions of the tibia, cranium, and other bones of the body. Contusions of the back may also occasion inflammation of the ligaments and intervertebral cartilages, terminating in ulceration or a kind of gradual sloughing. Experience supplies convincing proofs that such and similar accidents, as sprains, frequently become an exciting cause, that develops the latent predisposition to scrofula, and calls it into active operation on the injured parts, as in the joints, &c. Independently, however, of any occasional or exciting cause, scrofula may be induced in all or any of the structural parts of the spinal column, and may produce (as dissection has often demonstrated), caries, absorption, and ulcerative destruction of the bodies and car-

tilages of the vertebræ, and disease of the ligaments. In some cases of this kind, unequivocal and lamentable marks of scrofula have also manifested themselves in the lymphatic glands, or in the joints of the extremities, or have appeared after death in the lungs, or other viscera.

Syphilis has been detected as an occasional cause of caries of the bodies of the vertebræ, as well as of disease of the ligaments and intervertebral cartilages, in the same manner that it has displayed its morbid effects on similar structures differently situated.* In children, the occurrence of caries from this cause must be extremely rare; but, in adults, no doubt can be entertained of its having been a cause of caries of the vertebræ, and precludes the idea of scrofula being the sole cause.

Sprains of the back will produce inflammation of the ligaments and spinal joints, which may extend to the membranes of the spinal marrow, as well as weakness of the muscles and ligaments; and will, therefore, give rise to diseased action in those parts, the same as is more familiarly observed in sprains or injuries of other joints; some cases of which are found on record. They may, also, lead to distortion, by inducing long-continued inclinations of the spine to one side or the other, for the sake of ease.

Although the effects of rachitis may depend upon a yielding softness of the bones, arising from a deficiency of earthy, and an excess of animal matter; yet, in a mechanical sense, rachitis may, as far as it affects the osseous structure, be defined a constitutional predisposition to an unnatural malformation of bone, and is another cause of spinal distortion, that very obviously produces its primary effects by an irregular growth, altering the relative proportions of the bony parts of the vertebræ, which are necessary to preserve their horizontal surfaces on a level, and to keep the spinal column in an upright position.

Should mollities ossium invade the vertebræ, it produces curvature, by some portion of the bones yielding, on being compressed, so as to alter that proper and relative proportion of the parts of the vertebræ, which is absolutely requisite to the maintenance of the erect attitude. — *See an interesting case in Wilson on the Bones, p. 256.*

Rheumatic inflammation occasionally takes its seat in the joints and muscles of the spine, and may produce those changes that lead to distortion, by causing an enlargement of bone and ligament, and a loss of muscular power, the same as it does in similar structures differently situated. It may, also, occasion distortion, by compelling patients to observe a long-continued deflection of the vertebræ from the natural axis.

All have been taught, in their anatomical lectures, that, as the infirmities of old age steal upon us, the anterior portions of some

* See Mr. Wilson's Case, 3 vol. Medico-Chirurgical Transactions; Van Swieten's Commentaries; Chap. x., Sect. ii. of this Essay, and Ollivier, p. 198. Obs. xx.

of the intervertebral cartilages often become absorbed, and occasion the bodies of the vertebræ, at this part of the column, to approximate, and even to ankylose; by which, the spinal pyramid is permanently bent forwards, and forms an outward curvature, that may be aptly termed the excurvation of "senility." Solicitors, and other persons who sit long over their desks in the attitude of writing, are most subject to curvature from this cause. Long-continued malposition, such as stooping forwards or bending to one side, may produce effects nearly alike in the young, and make them (as it is termed) round-shouldered. — See *Sir J. Earle on Curved Spine*, p. 6.

It has of late been assumed, by a physician in considerable practice in these diseases, that they have their origin in relaxation of the vertebral ligaments, which, he says, is "the true cause of spinal complaints," and gradually produces "a luxation or subluxation of the vertebræ." — See *London Med. and Phys. Journals*, for November, 1820, and February, 1821. These opinions have been combated by me, in the same Journal, for August, 1823, and the principal arguments will be here adduced, for considering them unequal to the satisfactory explanation of the consequences of curvatures, and some reasons will be offered for rejecting them as a cause.

Ligaments, says Mr. Wilson, with one exception, possess no elasticity, they, therefore, do not yield, when pulled, but resist until torn through. The ligaments of the spine are all corroborating and not loose. — *On the Bones*, pp. 69, 72. It is not intended to deny that relaxation of the ligaments of joints sometimes occurs in adults reduced in strength and flesh by disease, and great relaxation of the ankle, wrist, and knee-joints, occasionally occurs in children, by which their extent of rotation and movement is greatly increased, and in relaxation of the ligaments of the ankle-joints, the patients are often rendered incapable of walking on the flat sole of the foot, but are under the necessity of walking on one side of it, more particularly on the inside; and Sir A. Cooper has lately recorded two instances of dislocation of the patella from the same cause.* Still, unless future facts and experience shall convince me of the contrary, I shall distinctly deny, that either permanent curvature of the spine, or luxation of the vertebræ of the spinal column, is caused by relaxation of the vertebral ligaments. First, because the joints of the spine are secured, not by one, but by many ligaments, and dissection has not yet disclosed to me that relaxed condition of the vertebral ligaments, which can be justly considered the cause of curvatures of the spine, or of the vertebral "bones not holding together." In my own dissections it has not been observed; and in the dissections of Dr. E. Harrison's two cases, which have been recorded (and they are only two of his), no such appearance is mentioned.

* See A. Cooper, Bart., on Dislocations, pp. 11, 12.

Secondly.—Let it be admitted, for argument's sake, that relaxation of ligaments does exist, and allows of an extensive play and motion of the vertebræ on each other, still it would not necessarily follow, that such a state should be the cause of spinal curvature: for it has been stated, and can be clearly demonstrated, that no permanent curvature of any part of the spine can be induced, as long as the bodies of the vertebræ and intervertebral substances preserve their natural dimensions; and this they could and must do, if the disease be confined to relaxation of ligament.

Thirdly. — If relaxation of ligaments were the cause, it would naturally result from the superadded powers of increased and extended motions of the vertebræ, the same as is observed in the ankle-joint; that, if the bones could be displaced and curved with facility, from the ligaments not holding them together, they could, also, be at once replaced in their natural line, with the same ease, by mechanical force, and the crooked soon made straight. But the fact is, I have never seen a case of *permanent* curvature of the spine, in which the projecting and arched bones could be reduced, at once, to their proper spinal line by any force or means whatever, nor a case that gave satisfactory evidence of relaxed ligaments and loosened vertebræ.

Fourthly. — When several of the bodies of the vertebræ are destroyed by progressive or ulcerative absorption, what powers prevent the spine from separating or dividing at this point? or, to adopt the phraseology of the abettors of the doctrine we impugn, what holds the remains of the half-destroyed bones together? The answer must be, there is no other competent power than the ligaments, which are somewhat assisted by the muscles: but, it is a well known fact, that the muscles will not hold a joint together after the ligaments are rendered incompetent, or are destroyed. The ligaments are first assisted by the muscles, and, subsequently, much more so by the ankylosis of the spinous processes, and sometimes of the other articulatory processes.

Fifthly. — If the spinal ligaments were relaxed and elongated, the practice of very forcible extension of the spine by machinery would be very injudicious and pernicious, as it would tend to loosen and elongate them further; yet the physician alluded to always employs this remedy. Lastly, if the doctrine were true, Avicenna and Dr. Glisson would have a long priority of claim to it.

Having denied the premises, it follows that I cannot admit the consequences, and reject the easy transition from relaxed ligament as a cause, to luxation and subluxation of the vertebræ as effects: first, because neither dissection discloses, not even in Dr. E. Harrison's own cases, nor do the preparations in the anatomical museums display either of those states after death. 2dly. Because we have not seen either state of luxation in any case of distorted spine in the living. 3dly. Because we are skeptical enough to believe, that complete luxation of the spine must necessarily be followed by death, notwithstanding Dr. E. H. states that, on exami-

ning his patient, F. G. Pratt of Camden Town, ten months after the accident occurred, he "found the first lumbar vertebra wholly dislocated, and driven into the left loin. The last dorsal and second lumbar were also displaced, &c.,"* and subluxation must be followed by pressure on the spinal marrow, producing paralysis of the parts inferior, convulsions, and even death. Indeed, if relaxed ligaments admitted of the extended play of the vertebræ on each other, we might induce paraplegia, and remove it at our pleasure, by causing subluxation and pressure on the spinal marrow. 4thly. The best and greatest authorities, Sir A. Cooper, Pott, and Boyer, declare there is no dislocation. 5thly. In those cases where several of the bodies of the vertebræ are destroyed by progressive or ulcerative absorption, and in which the dislocation of the processes would be the easiest, luxation has not been induced, or, at least, not recorded; but Nature, always wise, always preservative in her efforts, prevents such a result, by forming an ankylosis of the spinous processes, that must be broken before any dislocation can ensue.

Aneurisms, and other tumours, occasionally lead to spinal distortions, by the effects of their pressure on the spinal column; but, sometimes, the pressure of such tumours will produce absorption, and even caries of the vertebral bodies, without occasioning curvature.

Cerebral affections have been ascertained to be the origin of curvatures, more particularly of the temporary variety, and, by producing long continued muscular debility, to have led to permanent spinal distortion.

Numerous facts support me in stating debility of the dorsal muscles, however induced, to be the cause of temporary curvature, and by its conducing to habitually bad positions of the body, is the predisposing cause of permanent curvature of the spine. It is also clearly demonstrable, that a general muscular debility induced by a general cause, such as fever, measles, &c., which necessarily involves the dorsal muscles, frequently occasions relapses by increasing the curvature, as it always does, where it has previously been in a state of progressive improvement. Muscular debility may be innate, or the power of the muscles may have been developed and subsequently lost. The former occurs during infancy, the latter during childhood and adult ages. Patients, who exhibit debility of the dorsal muscles in childhood, sometimes display marks of incomplete formation of some of their bones; thus I have seen, in

* See Med. and Phys. Journal, for December, 1820, p. 449. This boy is since dead, and on examining him, Mr. Shaw discovers it to be a case of "fracture in a horizontal line in the middle of the first lumbar vertebra, the lower half continuing attached to the other lumbar vertebræ, the upper to the dorsal!! The two portions are united together obliquely by a ligamentous matter, so that, at this part, there is an appearance of dislocation; but there is not the slightest displacement of any of the other vertebræ. The spinal marrow is completely destroyed at the fractured part." — P. 77 of Mr. S.'s *Work*.

such cases, the shafts of the bones of the extremities very small; and, in two instances, the clavicles were divided into two portions, united by a ligamentous structure, that by degrees become ossified. Debility of the dorsal muscles has been induced by diseased brain, rheumatism, or the general weakness ensuing from dentition, or febrile diseases.

There is something peculiar in many cases of the temporary curvature arising from the inadequate power of the dorsal muscles to sustain the spine in the upright position; for, if the patient attempt to assume the erect attitude, the whole column is bent from the "straight" line, into "the shape of a half bent hoop," just such as the back would take, when any one voluntarily curves it to a great extent, by bending forwards and projecting the lower dorsal vertebræ backwards, a posture in which all the vertebræ would be, more or less, implicated in the curvature. It has been assumed, that curvature from this cause, necessarily involves *all* the vertebræ, but this does not accord with experience, for several cases occur in which the curvature is limited to the dorsal vertebræ between the scapulæ or the lower dorsal and upper lumbar vertebræ, and is probably induced by the infant being placed too much in the upright posture, before the muscles have acquired sufficient power to sustain the back erect.

It has been affirmed by Mr. Baynton, that no one of the vertebræ projects more than another in this variety, but that the spine appears just as if it were moderately bent by the will. After a short duration, however, an attentive examination will frequently detect one or three spinous processes to project more or less from the middle of the curve, and the skin to be stretched and appear whiter over those processes.

At an early period of this form of disease, no structural change takes place in the vertebræ, and none would ensue, if proper means of prevention were employed; but, should the patient be neglected, the structural changes, which lead to permanent curvature, will sooner or later be induced, however they may be deferred for months, or even years, when any circumstance has caused the patient to be confined more than usual to a recumbent posture, by which its progress has been retarded; for some parents, with apparent accuracy, trace the origin from muscular debility to so early a date of existence of their children as three months, and have been able to describe the increasing progress and gradual effects of this predisposing cause, leading to permanent curvature, from that period up to adult age.

SECT. II. — *Proximate or Immediate Causes of Curvatures, and particularly of Excurvations, with a Remark on Predisposition.*

If an inference may be allowed from the results of cases left to

nature, I would deduce that, in curvatures of the spine, there frequently exists a predisposition to absorption of the vertebræ, not independent of pressure, but which renders them liable to be absorbed from its effects. Which predisposition in some cases, is probably removed or ceases, before the vertebræ are relieved from the pressure; because, if it did not, the absorption would proceed *ad infinitum*, as long as curvature existed, or at all events, until so many of the bodies of the vertebræ, or so much of their anterior portions were absorbed, that the upper part of the sound spine no longer came in contact with the lower. This is not always the case, as it is ascertained by dissection, and the inspection of the various museum specimens, that a deposition of osseous matter, in many instances, takes place and supersedes the destructive process of absorption; add to this, that every day's experience proves that the diseased surfaces of the affected vertebræ gradually become united by ankylosis, even when the patients have declined all surgical rules, have spurned all restraint, and have not devised any means to relieve the vertebral column from the pressure of superincumbent weight, which had previously been so destructive. This subject will be reverted to, and further illustrated, when lateral curvatures are considered. The proximate or immediate causes of permanent excurvation, as of vertebral distortion in general, should be sought for in some morbid alteration or destruction of the structural parts of the bones and intervertebral cartilages. Inflammation, ulceration and caries, terminating in absorption and destruction of any of the bony parts of the vertebræ or intervertebral substance; progressive absorption of these parts from pressure; an increased or unequal growth either of the bodies or processes of the vertebræ, producing a disproportion of thickness and size between their relative parts, such as are seen in other bones more exposed to view; and progressive absorption or ulcerative destruction of the intervertebral cartilages, from any cause, may be considered ultimate effects, which occasion permanent distortion of the spine by mechanical agency, for they all alter the natural proportions of the spinal pyramid, on which its erect attitude principally, and of necessity depends.

The morbid alteration most frequently met with, is a reduction of the bodies of the vertebræ and intervertebral substances from a state of equal thickness to a cuneiform shape; the ordinary destruction produces either a partial or total removal of one or many of those bodies and intervertebral substances. This alteration or destruction of structure is effected by "ulcerative absorption," or caries, of the vertebræ; by "progressive absorption" of the vertebræ, without caries or formation of pus; by an irregular growth of bone, whether combined with progressive absorption or not; or by either an ulcerative or progressive absorption of the intervertebral cartilages. To effect permanent distortion, this alteration of structure must produce such disproportions in the mechanism of the spine, as not only oc-

casion a deflection from the upright attitude, but are incompatible with its retaining it, and render it impossible to place or restore the spinal column, at once or at will, to its perpendicular state, or to its spinal line or natural axis, either by the powers of volition, or by any mechanical power.

Ulcerative absorption (or caries) of the vertebræ and intervertebral cartilages has been certainly produced by scrofula, tumours, syphilis, and, very rarely, by rheumatic and simple inflammation.

Progressive absorption of those parts is produced by tumours, in a direct manner, and indirectly by contusions, sprains, rheumatism, bad habits as to posture, during the growth of bones, &c., that conduce to this effect, by occasioning the body to be for a long time deflected from the spinal line, and thus subjecting particular parts of the vertebral structure to long-continued and undue pressure, which is a very powerful means of exciting absorption. When an increased growth of bone on one part of the vertebræ inclines the spinal column from its straight line, it occasions increased pressure, and often consequent absorption on the opposite side. Progressive absorption, by a law of nature, frequently takes place in old age, without any extrinsic or evident cause.

Caries, or ulcerative absorption of the bodies or processes of the vertebræ and intervertebral cartilages, do not necessarily produce curvature, projection, or any distortion of the spine; for, as these latter effects are secondary and mechanical, their production must depend upon the direction the ulcerative absorption takes in the destruction of the bony and cartilaginous organization; for, if the ulcerative absorption merely takes away portions of the vertebræ and intervertebral cartilages in the perpendicular direction, enough may remain to support the spinal column in its natural attitude, and to preserve its spinal line; but, should the horizontal surfaces of the bodies of the vertebræ, with their intervertebral substances, be destroyed or absorbed, as so frequently happens, then the spinal column cannot be placed or supported in the upright attitude; and if a weight, as of the head and other parts superior to the absorbed portions, be thrown on the spine in this state, it must be deflected from the spinal line; and, should it fall forwards, the spinal processes must be elevated, and protrude behind.

To illustrate. — Suppose a circular or oval pyramid were erected of many pieces of wood and stone; if a segment of one or more stones, or nearly half a circle were cut away by the chisel in a perpendicular direction,—or if two segments, of smaller dimensions, be similarly cut away on the opposite surfaces, and a central transverse piece be left,—or if parts of the pyramid be cut away all around the circumference, and sufficient of the centre be left,—or if one or more stones be excavated or cut away, so that only three, four, or more small pillars remain,—still the pyramid would stand, as many antique ruins evince; but if the horizontal

superficies of the upper or under side of even a single stone be cut away in an oblique direction, in the shape of a wedge, the pyramid must either incline from the perpendicular attitude to one side, or it must fall altogether.

In like manner, anterior, lateral, central, or posterior portions of the bodies of the vertebræ, with their intervertebral cartilages, may be absorbed in the forms and directions I have supposed the pyramid to be cut away, and yet the spinal column shall preserve its erect attitude and spinal line. This fact is clearly established by the evidence dissections have furnished,—by the appearances the preparations in the various anatomical museums present to our view,—and by the plates given of this disease by several authors; and, accordingly, instances of this fact, or of extensive caries of the bodies of the vertebræ without curvature, are recorded by Mr. Pott, Mr. Lloyd, and some other authors, who have treated this subject systematically; but they do not offer the explanation of the circumstance here given, nor have they particularly mentioned whether the caries destroyed the bone horizontally or perpendicularly; the latter, however, may with safety be inferred, as, in such cases, it is sometimes stated that the caries had more especially destroyed the anterior surfaces of the vertebræ: which destruction, it must be supposed, was that of a segment or section,—at all events not more than a semicircle. It should also be remembered, that, besides the mechanical support given by the remaining undestroyed or unabsorbed portions of the bodies of the vertebræ, the muscles of the back, the ligamenta interspinosa, intertransversalia, and capsularia, offer some opposition to any unnatural curvature, and, together with the processes and posterior spinal ligament, oppose an almost insuperable obstacle to the complete luxation of the vertebræ, or the separation of the upper from any inferior part of the spinal column, such as would happen in an architectural pyramid, that has no such collateral supports.

Satisfactory evidence, from the same convincing sources of information already enumerated, will also prove, that whenever curvature of the spine is attended with caries of bone, such caries or ulcerative absorption has frequently been induced on several vertebræ at once, and has always destroyed the horizontal surfaces of their bodies, both above and below, not unfrequently in an oblique direction, so that the bodies of the vertebræ (which are carious) gradually diminish in depth from the posterior to the anterior surface, and are reduced into the shape of a wedge,* whilst the intervertebral cartilages are, in general, proportionably absorbed and destroyed, as far as the caries has extended.

Hence it is, the spinal column is gradually deprived of the mechanical support, that, in the erect attitude, it receives anteriorly;

* See plates in Mr. Ford's Treatise on Diseases of the Hip-Joint, &c., &c., and some admeasurements given of such vertebræ further on.

and when pressure is made from above, by the weight of the head and parts superior to the caries, the spine must incline more and more forward out of its spinal line, in proportion as the horizontal surfaces become more and more destroyed by ulcerative absorption.

When the bodies of one or more vertebræ, and their intervertebral substances are wholly absorbed, the spinal column is, at those points, completely deprived of all perpendicular mechanical support, anteriorly; and its upper part would fall off, or be separated entirely from the lower (as would an architectural pile thus situated), were it not prevented by the muscles of the back, the ligaments of the different processes, and the processes themselves, which are seldom involved in the prevailing destruction, all of which concur in preventing the spinal column from being dislocated, even in the most extensive state of ruinous disease.

When progressive absorption of the bodies of the vertebræ and intervertebral cartilages takes place, without caries or the formation of pus, however it may be induced, the same mechanical results and structural deviations must follow, as if they had been destroyed by caries or ulcerative absorption: which is exemplified in Miss Jane Archer's case, related in this Essay. The curvatures arising from progressive absorption, generally occur in children and young persons, during the growth of their bones, when the osseous structure is not very solid; the formation of the curvatures is gradual, and their extent must necessarily be proportioned to the quantity of the horizontal surfaces, or the number of the vertebræ or intervertebral cartilages absorbed. This should teach parents to observe the attitudes of their children, and endeavour to check or counteract any bad habit, as to the posture of the body, that tends to throw unequal pressure on any particular part of the spinal column.

The part of the subject next to be discussed may be premised by an illustrative observation, that if a wedge, or wedges, be driven between two or more divisions of an architectural column, they must, after first raising and gradually inclining it from the perpendicular to one side, finally overthrow it.

As long as the constituent parts of the vertebral column accurately maintain their relative proportions, agreeable to their natural formation, no permanent curvature or angular projection can take place. If in this state, a wedge were applied between any two vertebræ on any side, the spinal column would be forced out of its spinal line, and incline to the opposite direction.

Thus, if it were applied posteriorly, it would cause it to deviate from its spinal line, and bend forwards, and *vice versa*; and if the wedge were driven in between two vertebræ on the right side, it would occasion the column to incline over to the left side, and *vice versa*; and, were it not for the retaining powers of the muscles, ligaments, &c., the spinal column would be dislocated or overthrown altogether. In this point of view, as well as in those we

have already taken, of the effects of ulcerative or progressive absorption of the horizontal surfaces of the vertebræ and intervertebral cartilages, permanent curvatures, or angular projections of the spine, are merely mechanical consequences; and if we can demonstrate that a power equal to, and acting on the principle of a wedge, be applied in such cases as a cause, I shall prove the position just laid down. Here I must recur to the old exploded doctrine of unequal growth, or malformation of bone, which has been assumed, by Glisson and others, as an efficient cause of distortion; a doctrine exploded, too, against the evidence of the most perfect of our senses; for, in the anatomical museums, specimens of deformity arising from the unequal and irregular growth of all the bones, and of course of the vertebræ, may be seen; in some of which, the malformation or inequality is produced by diseased actions, but in others simply by an exuberance of the "formative principle," or by an error of nature, in exciting pruriency, or occasioning a deficiency of growth. It can only be intended, however, to offer illustrations of the effects of this error of nature in the vertebral column; and this I am enabled to do in a manner that appears satisfactory, by resorting to the appearances which dissection discloses in H. Pittam's and other cases, as A. Selby's,* and examining the preparations of the various distortions of the spine, that are placed in the Hunterian, Brookes's, and other splendid collections of morbid anatomy. In viewing the preparations, and in the dissection of spinal deformities from irregular growth of bone, the disproportions of the different bodies and intervertebral cartilages, that is, between their outer and inner lines of curvature, are most striking; the thickness of the vertebræ and intervertebra substances being sometimes, on the outer line of curvature, double or even treble, of that of the inner line. It therefore remains to be explained by what process this immediate cause produces its consequences.

When an increased growth of bone takes place on one side of the spinal column, which is a flexible one, it must necessarily elevate the parts above it on the same side, and make them recline over to the opposite side, which is thinner, and that must now sustain the greater share of weight; one consequence of which must be, that a greater degree of pressure will be made by all superincumbent weight on the thinner side, to which it is reclined, whilst it will be diminished on the side which the increased growth has elevated; and, indeed, whilst the superincumbent weight will press the surfaces of the joints more closely together on one side, it will tend to open the joints, or separate their surfaces on the other, and put the ligaments on the stretch, and (as it were) create a space for interstitial deposition.

Now pressure is the strongest power we possess of producing local absorption, and as increased growth of bone is a cause of

* See the Cases.

a permanent nature, the pressure too becomes permanent (except in particular positions of the body), and occasions absorption of that part of the bone, and of the intervertebral cartilage unduly pressed upon. Thus, increased growth on one side, and progressive absorption occasioned by pressure on the opposite side, both conspire to the same end, and both operate in destroying the natural proportions of the vertebræ, and of deflecting the erect spine from its spinal line to the form of a curve; and, in the degree that increased growth takes place on one side, and increased pressure and absorption on the other, the greater or less must be the curvature. Besides, as these causes extend their effects, the number of the vertebræ involved in the curve will be increased, until many are bent into an arc, some of which have had their dimensions increased on one side, and all of them have been diminished on the other, — which is a very important fact to be borne in mind in the treatment. During this deforming process, we may reasonably believe the muscles and ligaments offer some resistance to its progress, but effects show their resistance is overcome.

The explanation just offered, will be deemed satisfactory, as far as it relates to the manner in which lateral curvature is produced by an irregular growth of the vertebræ, even on the most superficial reflection, and perhaps, as far as incurvation arises from this cause; but it may not be considered a striking elucidation of the mode, by which the excurvations and angular projections of the spine are induced. Let us then examine how far the explanation is applicable. By H. Pittam's dissections, and in some anatomical preparations of curved spine, it will be seen that a morbid enlargement or increased growth of the transverse and spinous processes, or of the bony bridge of some vertebræ, occasionally occur; the mechanical effects of which, are varied and progressive. — First, the enlarged bony bridge presses on the posterior part of the vertebra immediately below it, and sometimes occasions more or less absorption of it: secondly, it must elevate, like a wedge, the spinous processes above, and occasion them to protrude from the spinal line and form an angular projection: thirdly, should the growth of bone increase, then, in proportion as the posterior portions of the vertebral bones become further enlarged, must the spinal column be eventually inclined forward more and more, and the weight of the parts of the body above, which in the natural attitude, is equally borne and divided by the horizontal surfaces of all the vertebræ, will be thrown in an unequal degree upon the anterior surfaces of some of them, and subject them to the consequences of unnatural pressure.

Although the application of the above doctrine, in explanation of the mode in which excurvations are produced, may be considered a revival, and the subject of malformation of bone, has not been so fully investigated as to render the profession familiar with all its peculiarities and deviations; it seems proper to state, that I have met with cases of excurvation which could not be fairly attributed to

any other cause than rachitis, in the sense I have employed the term. Where the rickety diathesis to vertebral malformation prevails, it would appear that superincumbent weight and pressure are not always necessary to the production of curvature, and that a long observance of a proper position alone, will not counteract it. This is most forcibly illustrated in the singular case of spina bifida, which occurred in A. Selby, and was published by Mr. E. Jukes, in the London Med. and Phys. Journal, for February, 1822, without any mention of, or reference by him to the spinal curvature. Mr. J. has stated, that, except the hydro-rachitic tumour in the loins, she was otherwise well formed, and could walk about until the age of eight years, when (he informs me) the spine was quite straight: she then became club-footed and unable to walk, and as the tumour increased and projected much beyond the spine, she could not lay on her back, so that she was constantly confined to the facial horizontal or obliquely lateral positions for fourteen years, during which time an excurvation of most of the dorsal vertebræ was formed, without the aid of caries or progressive absorption, from pressure.

This curvature is represented in the plate published with the case.

Two circumstances will, however, conduce, in most cases, to the formation of excursions by irregular growth of bone: one is the continually increasing enlargement of the posterior portions of some vertebræ; the other is the absorption of the anterior portions from mechanical pressure.

Besides this effect on the anterior portions of the vertebræ, there is also a particular effect produced, by the general derangement, on that vertebra immediately inferior to those involved in the curvature; for, by the deflection forwards, the superincumbent weight of the head and other parts above the curvature is not equally borne by all the vertebræ, as when they preserved their proper axis or spinal line, but the weight must be thrown on the posterior portion of that inferior vertebra which still preserves the spinal line; and, if it be not so very firmly fixed as to be enabled to retain its situation, until it is partly relieved from pressure by the absorption of the vertebræ above, it must be inclined backwards or outwards, as will others in succession similarly situated, and add to the extent of the curve; and thus we see the vertebræ, both above and below the first vertebra observed to be protruding, gradually formed into a curve; but if the vertebra immediately below those involved in the curvature be firmly fixed, and equal to support the superincumbent weight without being displaced, it becomes the extreme of the cord line of the curvature. The latter is frequently the case with the fourth and fifth lumbar vertebræ; the former of the dorsal, they being the most subject to excursions. In the specimens of excursion in Mr. Brooke's museum, attended with destruction of some of the bodies of the vertebræ, the vertebra and intervertebral substances below the curvature, are

thinner than natural on the posterior surfaces of their bodies, where the superincumbent weight has been wholly thrown, and thicker on the anterior, which have been relieved from superincumbent weight by the absorption of the bodies of the vertebræ above.

In those cases, it is found, that some interspinous ligaments are more or less elongated (a term preferred to relaxed, as it conveys a more precise meaning of their condition, for they are stretched from being on the outer line of the curve, and are rather tense than relaxed), and some spinous processes separated at unusual distances from each other, in proportion to the extent of the curvature; for when an elastic body of some thickness is bent from the straight line into the form of an arc, the outer line of the arc or circle, and portions contiguous to it, must be put on the stretch, whilst the inner line of the arc or circle, and portions adjoining, must be compressed; but, if a body thus bent should consist (as in the case of the spine it does), of different substances, one elastic and compressible, and the other inelastic and incompressible, the first must be altogether stretched on the outer line of the curve, and the most compressed, or at least yield most to compression, on the inner.

By this compression, however, being applied to the inner line of curvature, in excurvations, which is, of course, to the anterior portions of the vertebral column — it acts primarily on the elastic and compressible intervertebral cartilages; and hence it is, that they are, in general, first carried away by the absorbents, and the bony parts secondly: at least, such is the legitimate deduction from dissections; for, whenever the horizontal surfaces of the bony parts, or the bodies of the vertebræ, have been partly destroyed by ulcerative or progressive absorption, the intervertebral substances have been nearly or wholly so. It has, indeed, sometimes happened, that the ulcerative absorption has not removed much of the cartilages, when it has destroyed much of the bodies of the vertebræ in the perpendicular direction; whilst, on the contrary, it has occurred, that progressive absorption has removed the intervertebral cartilages, and left the bones entire; of which circumstance, a plate is given in Mr. Copeland's *Observations on Diseased Spine*, and a specimen may be seen in Mr. Brookes's museum, and of which familiar instances are met with in the curvatures of senility.

In cases of curvature, progressive absorption of parts must be in the ratio of the compressing power to which they are subjected; and thus, the compressed parts will be absorbed and diminished in thickness in the ratio of the compressing power they sustain, and of their degree of liability to absorption. Thus it is, adult patients or the parents of children, so frequently represent that, after the curvature has attained some extent, it has increased very rapidly. This may be partly explained by a principle in mechanics. If a small column be perfectly upright, it will bear a considerable weight, as long as it preserves its perpendicularity;

— but if a weight be affixed to the upper extremity of an elastic column, curved to the degree of one, and the same weight be placed upon the upper extremity of another, curved to the degree of three or four, — in the latter case, the superincumbent weight will tend to increase the bending of the column with a greater force and effect than in the former ; hence, the more extensive the curvature, the greater will be the compressing power of the superincumbent weight, and the quicker the absorption that is established and going on.

In some constitutions, this absorption will go on without inflammation or ulceration being excited by the pressure : at other times, in less fortunate constitutions, slow inflammation and ulceration will be either speedily or eventually produced ; and, thus it is, that pressure may induce both the ulcerative and progressive absorption ; but the ulcerative is much less frequently induced by it than the progressive. From the appearance of the remains of some parts of the bodies of the vertebræ, it may be reasonably inferred, that the action of the absorbents continues in the vertebra, that has been exposed to compression, for some time after pressure has been removed ; for if the horizontal surfaces of the upper and lower remaining vertebræ were placed on each other, they would not form a regular coaptation, but would appear like irregular surfaces.

From the facts adduced, and the illustrations offered in this chapter, I think it may be deduced, as proved ; — that the erect attitude of the body depends upon the vertebræ and intervertebral cartilages being of equal thickness, and that it cannot be preserved without this just proportion. That the temporary flexions of the spine are performed or permitted by those cartilages yielding to pressure, so that their thickness becomes temporarily altered. And that all permanent curvatures of the spine are caused by, or result from, the bodies of the vertebræ and intervertebral cartilages being reduced to a cuneiform shape or entirely destroyed ; in which disproportionate state of parts it would be impossible to place the spine in the perpendicular or erect attitude.



CHAPTER IV.

PROGNOSIS AND DIAGNOSIS.

SECT. I. — *Prognosis.*

THE prognosis may be favourable, as far as it relates to the preservation of life, or its dissolution, in all cases, where there is no scrofulous diathesis, and the treatment is begun in the early stages

of disease. The prognosis that relates to the restitution of the vertebral column to its true spinal line must be a distinct consideration, and will be hereafter noticed.

When the curvature is caused by caries of the vertebræ, or gangrenous destruction of the intervertebral substance, the prognosis should be unfavourable, and if caries be combined with the appearance of external abscess communicating with the diseased vertebræ, the termination is generally fatal, whether the abscess have the name of lumbar, psoas, or any other appellation or situation. In such cases, the general health and appetite fail, but not always the appetite; the digestive functions become impaired and deranged; the patient becomes gradually emaciated, he is affected with hectic fever, and is generally carried off by diarrhœa.

When the curvature, however large, is caused by progressive absorption of the bodies of the vertebræ, the extent of which may be ascertained rather imperfectly by measuring the cord line, the prognosis may be favourable, unless the patient be subject to attacks of asthma, as the general health continues tolerable.

Curvatures, attended with frequent headaches or constant cephalœa, are dangerous, and, with hectic fever, are fatal.

Curvatures caused by, or combined with, aneurism are fatal.

When a recovery is accomplished by ankylosis, after some body or bodies of the vertebræ have been destroyed by progressive or ulcerative absorption, more or less of the curvature or spinal projection remains; in a few cases, the spine may be said to be restored to its natural form, in those where the disease has been limited to one, or not more than three vertebræ.

Paralysis of the lower extremities is a symptom indicating danger, but many patients thus affected, recover.

When all spinal pain has ceased and the digestive functions are improving, and the organs of digestion act regularly; when, at the same time, the patient acquires flesh and spirits, and recovers the muscular power of the extremities, and is freed from dyspnœa, epigastric pain and tightness, and pain of the knees, and sleeps well, a speedy return to general good health may be sanguinely anticipated, as well as a termination of spinal disease, and, if proper measures be pursued, the curvature may be considerably, if not entirely, removed.

SECT. II. — *Diagnosis.*

The permanent deviation of the spine from the line of its natural conformation is a tolerably evident demonstration of this disease. This section is, therefore, chiefly introduced to call the attention to the establishment of some distinguishing symptoms between curvature with caries, or intervertebral ulceration or gangrene, and curvature without, and to consider what symptoms may awaken suspicion, and lead to an inspection of the vertebral

column, and detection of spinal curvatures in their early stages. The subject is difficult, and has not been much elucidated, because there are not many symptoms that are peculiar.

The corded tightness or sense of constriction across the epigastre is, perhaps, the only symptom peculiar to curvature of the dorsal vertebræ. Disordered respiration, with diminution of the muscular power of the back or extremities, or irregular actions or convulsions of the muscles of the latter, with a sense of weakness or weariness not easily accounted for from any other disease, should excite suspicion, and lead to an inspection of the back, as ought a constant habit of stooping forwards or leaning to one side.^a In the curvatures without inflammation or caries, there is very little accompanying pain, and no pain is, in general, stated to be felt, unless the affected vertebræ are pressed upon. Curvatures with caries are preceded and accompanied with more marks of inflammation, such as pain, slight attacks of fever, and constitutional disturbance.

In curvatures without caries, the patients generally retain a disposition to sit up and walk about; in those with caries, exercise frequently occasions pain, uneasiness, and speedy exhaustion of muscular power. In curvatures without caries, the general health is not often very much impaired, however great the curvature; at least, there are no symptoms from which much danger is apprehended: this general rule has its exceptions, as I have seen two cases of excurvation without caries, attended with dyspepsia, loss of appetite, torpid liver and bowels, and general emaciation; and one of the two was affected with paraplegia and disordered kidneys. Even in these, however, the countenance was more expressive of languor and debility than of pain.

In curvature with caries, the general health seems to be impaired from the first accession of the inflammatory stage, whether it be simple or scrofulous inflammation; there is more pain complained of, which the patient endeavours to relieve by assuming attitudes that take off particular pressure, as by leaning backwards, or to the one side or the other; the patient gradually falls away from the first, and looks pale and languid, even when his appetite is tolerable; scrofulous swelling of glands, or affections of the joints sometimes supervene; great mental irritability ensues; the muscles become soft and flabby; and when the anterior ligaments are ulcerated through, and pus or sanies escapes from the carious vertebræ or ulcerated or gangrenous intervertebral substance, the symptoms of hectic fever with cough supervene, and the patient is generally carried off by it, and a wasting diarrhœa, assisted sometimes by the discharge of pus emanating from the diseased

^a [Among the earliest symptoms of caries of the spine is an abdominal pain like colic, felt chiefly at night, producing morbid *insomnia*, and a desire for motion or gestation in the arms of a nurse. — Ed.]

vertebræ. This diagnostic is not very satisfactory, but the history of the general state of health accompanying curvatures has often been the best guide in forming a diagnostic opinion, so much worse is it in curvatures with caries than without. The inflammation, ulceration, or gangrene of the intervertebral substance have appeared to me to be attended with more local pain and tenderness, and more general suffering than caries of the bony structure, and the ulceration of the anterior spinal ligament is sometimes longer deferred in the latter case, but, when induced, abscesses are the result, which generally terminate in hectic fever, emaciation and death.

There are not any early symptoms which may be pronounced *certain* diagnostics of a predisposition to curvature, or of an incipient curvature; when, however, a patient complains of any pain in the course of the spine, attended with a sense of constriction across the epigastre, and an occasional feeling of numbness or twitching of the upper or lower extremities, and is relieved by bending backwards, or to one side, or by laying down; suspicion should be roused and the back should be inspected. If any disease should exist, the dorsal muscles are generally wasted; if any degree of curvature exists, the projecting spinous processes will demonstrate it; if of inflammation, pressure, and the application of the hot sponge will excite pain. In curvatures without inflammation or caries, the hot sponge as often affords ease or comfort as it produces any other sensation.

In an incipient excurvation, the undue prominence of any of the vertebræ, or rather of their spinous processes, will be most displayed by bending the body forwards, in which position any unnatural projection becomes evident.

CHAPTER V.

TREATMENT OF EXCURVATION.

SECT. I. — *Means of Prevention, and Indications of Cure.*

BEFORE entering on the Indications of Cure, it will be convenient to consider the means of Prevention. In rheumatic affections of the spine, it frequently happens that the patient is compelled to observe a bent position of the spine, when sitting up or walking, but on laying down, especially on his back, the spine becomes straight. In such cases, the effects of bent position and of a consequent undue pressure on some portion of the vertebræ, in a morbid condition, will be obviated by the use of the recumbent posture, during the cure of rheumatism. When a similar effect is produced by a strain, by contusion, or by simple inflammation, the observance

of the recumbent posture, during the cure, will equally prevent the formation of curvature. Awry, or mal-positions of the spine, arising from bad habit, which lead to progressive absorption, may be prevented by recumbent posture, or, more conveniently to the patient, by the use of proper instruments of support, that obviate untoward position, combined with frequent observance of the horizontal position. When the incipient curvature arises from debility of the dorsal muscles, the patient chiefly observes a recumbent posture, from necessity, and if he continue to do so, and employ every ingenious mode of exercising the dorsal muscles in that position, and use mechanical supports to the spine when he is erect, until the muscles regain their power, a permanent curvature will be prevented. Generally speaking, in all cases of incipient curvature, the recumbent posture should be much adopted, with such a degree of exercise of the dorsal muscles, as each particular case will admit of; but if inflammation be present, exercise may be injurious; if rheumatism exist, it cannot be employed, and if the remote cause be sprain, contusion, &c., the pain from attempting exercise will prevent its use. — The subject of exercise will be resumed.

Some of the indications in the treatment of curvature of the spine are general, and will apply to its several varieties, whilst others will be particular, and peculiarly adapted to one variety only. The general indications applicable to all, are, to afford to the vertebral column effectual relief from pressure; to secure the bodies of the affected vertebræ from the irritation of motion in the erect attitude; to assist or enable the vertebral column to regain its true spinal line; to remove all constitutional and local symptoms of disease, and rectify all disordered functions; to promote the general health. The first, second, and last indications may be considered, at present, the others will be more appropriately entered upon in treating of the several varieties.

The first indication will be fulfilled by relieving and protecting the spine from *all* superincumbent or other weight. The reasons appear so obvious, why the diseased portion of the spine should be relieved from *all* weight and consequent pressure in this disorder, that it seems scarcely necessary to observe, that they should be removed; because pressure is the most powerful exciter of that absorption, by which the constituent parts of the vertebral column are gradually destroyed; because it may excite inflammation where it has not been created, and increase it where it does exist (in inflammation of other joints, all surgeons forbid them from being subjected to superincumbent weight and pressure); because too the portions of spine absorbed could not be regenerated, and the vertebral column restored to its spinal line, as long as the pressure is continued, not to mention, that during undue pressure, the intervertebral substance could not expand, so that this is almost an universal indication in diseases of the spine.

The means adopted, for the purpose of taking off all pressure

from the spinal pyramid, have been to confine the body in the recumbent posture, either on an horizontal or an inclined plane; and it should be determined, on due consideration, if one of these contrivances be preferable to the other, or if either of them be objectionable.

Should any one investigate the doctrine of the motion of bodies on inclined planes, in mechanics, he will find that all bodies placed on an inclined plane will gravitate on it with a relative gravity, which will be to the absolute gravity as the length of the plane to its height. It is also determined, that, as in a vertical plane, where the inclination is perpendicular, the gravity degenerates into absolute, and, as on an inclined plane, the respective gravity is in the ratio of its angle of inclination; so, in an horizontal plane, where there is no inclination, "the respective gravity vanishes."—Hence it is, that as every inclined plane makes an oblique angle with the horizontal plane, that approaches more and more to the perpendicular, where the gravity is absolute, or in other words, the weight is the greatest; it follows, that when the body is laid on the inclined plane, the spine must be subjected to the *sustenance of a weight in the ratio of its angle of inclination*, and as the admitted principle and object of particular position are to relieve it from *all* weight, the inclined plane is objectionable; for the diseased portion of spine must be subject to pressure from above, when the body is laid on the inclined plane, and can only be relieved from it by being placed on a horizontal one, where "the gravity vanishes," or the weight is entirely taken off; hence it is inferred, that the use of the horizontal plane should be preferred in all curvatures of the vertebræ, where recumbent posture is necessary; and that the inclined one is incompatible and inconsistent with the established principle and necessity of easing the spine from *all* superincumbent and other weight, and therefore objectionable.

The second indication will be fulfilled by rest in the horizontal posture, and by abstaining from all movements and positions whilst so *lying*, which throw weight on the bodies of the vertebræ. This seems necessary, because movements of the body in the erect attitude would, sometimes, produce a degree of friction and motion of the diseased vertebræ that would be injurious; because they would tend to excite inflammation and absorption; and because analogy points it out, as absolute rest is enjoined in almost all diseases of other joints. The advantages, however, of particular positions of parts or of the whole of the body, are so well estimated, and so generally acknowledged in medicine and surgery, that instances of their utility and benefit will naturally occur to the minds of all, as in reducing the various luxations of the thigh-bone, and as curvatures of the spinal pyramid take different directions, and form a variety of deflections from the straight line, so experience has fully convinced us that different positions of the body can be adapted to the different forms of curvature, with striking and peculiar benefit.

For the correct and clear comprehension, therefore, of the terms and operations mentioned in this dissertation, it is necessary to state, that three variations of the horizontal position will be employed in the treatment :— The dorsal horizontal position, or lying on the back ; the facial horizontal position, being the reverse of the former, or what, in common language, is called “lying on the face,” of course in a line with the sternum and linea alba abdominis ; the lateral horizontal position, or lying on either side. In all cases, the patients are supposed to be lying on a horizontal plane. The general health may be promoted in this, as in other cases, by a proper regimen in diet, good air, regular hours of sleep, and regulating the excretions.

SECT. II.— *Treatment of Excurvation of the Spine, or Curvature outwards.*

The general indications are all to be observed in this variety of curvature, and the fact of there being a suspended as well as a superincumbent weight on the vertebræ, in this case, does not vary the indication, but serves more strongly to enforce the necessity of relieving the spine from *all* weight, which is to be effected by a *proper horizontal* position. The propriety of having called the attention to the different variations of horizontal posture, will be best illustrated by the appropriate uses to which they will be applied, and the advantages resulting from such discrimination.

It is almost needless to observe, that, until lately, lying on the back has been the only recumbent posture employed, or indeed thought of, in curvatures of the spine ; my experiments have, however, proved the facial horizontal one to possess infinite superiority in this variety of curvature, and my surprise has been excited, that reasoning, *a priori*, had not sooner led to its adoption. Those reasons shall be now enumerated, and a comparison be instituted of the benefits gained by this and other positions.

When any one in health is lying on the facial horizontal position on a soft medium, for instance, a feather bed, the vertebral column partly by its absolute gravity, falls or inclines inwards more than in any other natural position of the body, and forms a graceful inward curve of the lumbar and lower dorsal vertebræ, and should the vertebræ just mentioned be those involved in the curvature or angular projection (as they frequently are), or should this portion of the spine entirely form either of those distortions, this position will of itself tend to diminish the curve, and restore the column to its spinal line. Should the greatest point of outward projection be in the lumbar vertebræ, the facial horizontal position puts the flexor muscles of the thigh on the stretch, which tends to draw the lumbar vertebræ inwards. By this position, the horizontal surfaces of the anterior portions of the vertebræ will be separated to the greatest possible distance, to be effected from particular position, by which, pressure will be effectually taken off from those portions ; irritation

removed; and an opportunity for regeneration of bone and intervertebral substance, as well as of its expansion, be afforded. This position enables the patient to exercise the muscles of the back, by moving the head backwards and forwards, or in any direction, by a very limited motion of the upper vertebræ, and by playing with the legs, without counteracting the two first general indications, by creating any pressure on the bodies of the vertebræ, and thus renders exercise of the dorsal muscles compatible with rest in the recumbent posture. And an excurvation is often remotely caused by an atony of the dorsal muscles; as physiologists infer that the development of the power of muscles is in the ratio of their exercise, and as it is a pathological fact, that muscles sometimes waste and lose their strength from inaction during disease, the importance of the moderate exercise of the dorsal muscles is manifest.

In this position, the patient has the free use of his arms, and can raise himself on his elbows, by which latter movement the scapulæ are pressed backwards from their new lateral situations, and directed to their natural site on the back, and during this position, if the head be bent backwards, the spinous processes, (separated in this complaint in the middle of the curve), and the posterior portions of the vertebræ are pressed more closely on each other, by which the spinous processes are approximated, the curvature diminished, and the anterior horizontal surfaces of the vertebræ still more relieved from pressure by their further separation.

In this position, extension of the column, by pulling at the arms and legs, can be conveniently accomplished at all times, as well as pressure made on the projecting vertebræ. This position renders friction, percussion, and shampooing available with convenient facility, and the management of issues, blisters, and setons, less troublesome and painful.

When this position has been observed about three months, it has followed in all cases, where the patient has not been pot-bellied, or abdomen corpulent, that the spinal line, which, previously to its use, was evidently posterior to the natural axis in almost the whole extent of the spine, is gradually altered, and transferred, so that the line of the lower dorsal and lumbar vertebræ become placed anterior to it, and when the patient assumes the erect attitude, the upper part of the body no longer stoops forwards, but falls backwards, and the patient can walk erect, with the lower part of the spine inclining inwards.

If the ribs have assumed the oval form, by which the sternum is projected, and the patient is chicken-chested; — in the facial horizontal position, the sternum, in resting on the bed, is pressed towards the vertebræ, by the whole superincumbent weight of that part of the body, and the ribs consequently pressed out on their sides, which tend to reduce the ribs from the oval elongation to their circular form. Lastly, the patient is permitted to lie comfortably on a soft feather bed, and comparatively enjoys a considerable freedom of movement, and can play, read, or amuse himself, in various ways, with books or things placed before him.

As the employment of the facial horizontal position is a new feature in the treatment of excursions of the spine, it seems incumbent to point out its peculiar advantages over the older practice of lying on the back. It might, indeed, be thought enough to state, that if any one will try the position recommended, he would, most probably, be surprised at the rapid manner the favourable changes are obtained *at first*, and the result would convince him of the superiority of its comparative merits.

To induce even this experimental adoption, it may be proper to consider the subject more particularly.

Most patients, since Mr. Baynton's suggestion of the practice, have been confined to the dorsal position either on an inclined or horizontal plane. With respect to the inclined plane, either the objections to its employment are valid and insurmountable, or the principle is erroneous on which particular position is founded; as the latter proposition cannot be admitted, the former must, and the consideration of this subject may be finally dismissed as unworthy of further discussion.

In some cases, in which I have been consulted, the horizontal plane in use has been differently constructed, and the body somewhat differently arranged upon it, under the previous direction of other surgeons: thus the plane has been framed of wood with a hollow in it to receive the occiput, so that the cervical vertebræ may be brought in a line corresponding with that of the dorsal vertebræ, or with no hollow for the occiput, but with loop holes to fasten or tie tapes affixed to the shoulders and legs, for the purpose of confining them, and with an opening in the centre of the plane, through which the bladder and rectum are emptied, without disturbing the position. In other instances, a mattress, without a pillow, has been used, to which the dress has been sewed or pinned, in order to restrain the movements of the patient. The object of these contrivances is to retain the body, as nearly as possible, immoveably fixed in the dorsal horizontal position, the defects of which, in this species of curvature, shall be now stated. In this position, the spine is in the greatest state of projection outwards that it admits of in the recumbent posture. The lower dorsal and lumbar vertebræ, in their natural line, "incline inwards to support the intestines," but if the patient, whilst lying on his back, bends the thighs or the body, these vertebræ are particularly projected outwards, and should this portion of the spine be the principal seat of excursion, as it is almost always that of angular projection, the dorsal position would be injurious, by its tendency to increase the protrusion. Indeed, this position is the best for incurvation or the opposite kind of curvature. In the dorsal position, on a hard medium, an adult suffers pain in the most projecting part, from the pressure against the hard plane, occasioned by the superincumbent weight, which is much less the case in childhood; and I have known cases where adults could not continue this position from the pain it excited, or from its producing excoriation.

In this position, also, I have known the flexors of the thigh to become contracted, from the patient keeping the thigh bent — it need not be observed how often this contraction ensues when the excursion or angular projection is combined with lumbar abscess.

In the dorsal horizontal position, the principle of taking off *all* superincumbent weight is not strictly observed, as the weight of the viscera and parts of the body above are partly borne by the vertebral column, and even this weight may be injurious, if the anterior spinal ligament or anterior portion of the vertebral bodies be inflamed. When the body lies immoveably fixed on the back, the dorsal muscles are entirely deprived of motion and exercise, and of the means of acquiring any degree of strength which exercise communicates, and which their previous debility, so often an accompaniment, renders desirable and necessary. In this position, no friction, pressure, &c., can be applied to the spine. This position continues to place the spinal line posterior to the natural axis of the body, as the vertebral column tends, by its own gravity, to incline outwards.

A practical fact or two may weigh more forcibly in the minds of the profession, than all reasoning or comparison of the merits of plans. — Miss Gilchrist, of Nelson Square, in 1816–17, became affected with paraplegia and increase of curvature, whilst she was confined to the horizontal plane with tapes, as already described. — Miss Downes, of Long Acre, became affected with paraplegia, and the excursion increased, during the ten months she was confined, in the dorsal horizontal position, to an inclined plane with a hollow for the occiput, from which she recovered in three months, after using the opposite position on an horizontal plane. She also became affected with dyspepsia, and morbid urine in the former position, which soon disappeared on changing it. The comparative value of the two positions, in excursions, may be thus summed up, and estimated.

In the facial horizontal position, the spine naturally tends by its gravity to fall inwards, and thus to diminish the excursion. In the dorsal horizontal position, the reverse takes place, and the spine would naturally tend by position and its own gravity to protrude outwards or backwards *ad infinitum*, or until the vertebral column was completely curved, unless the projection was counteracted by the resistance an unyielding plane affords.

In the facial horizontal position *all* superincumbent weight is effectually removed, which is not the case in the opposite posture. In the former, any pressure or irritation on the diseased surfaces of the vertebræ is prevented; in the latter, it is not. In the facial horizontal position, the muscles of the back and neck are frequently brought into action, which exercise conduces to the preservation or restoration of their strength and firmness; neither of which advantages can be obtained by the confined posture on the back; on the contrary, the inaction of those muscles is liable to produce atony and wasting.

In the former position, the patient can perform extension of the spine by grasping the bed-posts and pulling with his arms, provided his legs be fastened to the other end of the bed. In the latter position, this process cannot be performed, because the arms cannot be extended horizontally behind the head. In the facial horizontal position, pressure, friction, &c., on the outer line of curvature, may be employed at all convenient opportunities, and issues, blisters, and setons easily managed, which they cannot be in the contrary position.

In the facial horizontal position, the projecting sternum is pressed towards the vertebræ by the effects of superincumbent weight; in the other position, the sternum is seen to heave up and down with the action of respiration, and its protrusion is not counteracted:—In the former situation, the spinal line inclines inwards, in the latter, outwards. In the facial horizontal position, the patient's situation, which must be at all times irksome in a confined posture, is rendered as agreeable as possible, as he is placed on a soft feather bed, and enjoys some little freedom of movements. In the opposite position, he must lay on a hard unyielding medium, to prevent the back from greatly curving outwards, and is fixed so as to be deprived of all motion, except what would be disadvantageous.

In the facial horizontal position, the patient can eat without inconvenience, which he cannot do in the opposite state. During the use of the dorsal horizontal position, instances of the induction of paraplegia have occurred, in the facial position such a consequence has not as yet ensued.

When excurvation is combined with abscess, and more particularly in the cases connected with gangrenous destruction of the intervertebral substance, and caries of the horizontal surfaces of the bone connected with it, the facial horizontal position enables the dark fetid pus to escape along the anterior parts of the vertebræ, whilst the observance of the dorsal would occasion it to lodge upon the theca vertebralis, to insinuate itself in the course of the medulla spinalis and occasion death. Some other advantages of this position have been mentioned, and the comparison need not be pursued farther, as it already savors too much of repetition. The reasons, for recommending a feather bed, instead of a mat-trass, to lie on, may be properly stated here. They are, because it yields to the weight of the abdomen, and allows the vertebral column to fall inwards; and should the patient have a tumid or corpulent abdomen, it permits it to sink into the bed, whereas, on an unyielding medium, a large abdomen rather elevates the part of the spine opposed to it; because its comfort is no inconsiderable advantage to one, who is doomed to a recumbent posture for many months; and because the beneficial changes it induces are more rapid, and its practical benefits greater. By observing the facial horizontal position, in conjunction with other means, for a length of time, to be regulated by the proportional extent of deformity, and the slow or rapid progression of its good effects, the vertebral

column will regain its spinal line, if not perfectly, at least to a very considerable degree, in excursions.

After the facial horizontal position has been observed three months in conjunction with the mechanical means recommended, it very commonly occurs, that the spinal line of the lumbar and lower dorsal vertebræ becomes transferred anteriorly to the natural axis of the body, and when the patient is placed in the erect attitude, he no longer stoops forward as he did previously, but the shoulders and upper part of the column incline backwards, whilst the inward bend of the lower part or loins causes the abdomen to project forwards. When the spinal line is changed in the manner just described, the patient should lie alternately on the dorsal and facial horizontal positions, by which the column will soon regain its natural axis; for when the patient lies on his back, the spinal column gradually inclines outwards or backwards.

When the excursion more particularly involves the upper dorsal vertebræ, so that the 3d, 4th, or 5th dorsal vertebra forms the centre of the curvature, the observance of the facial horizontal position will tend to reduce the vertebræ forming the arc, situated *below* the centre of the curvature, to their proper spinal line, more than it does the cervical and other vertebræ situated above the centre; for in this position, the weight of the head frequently bends the cervical and upper dorsal vertebræ forwards, more than it would in the opposite position, so that, it generally happens, the lower part of the curve is brought nearer to its spinal line, in a much greater proportion and shorter time than the upper.

In this case, after having observed the facial horizontal position for about three months, it is proper to reverse it, and place the patient on the back with the occiput resting in a hollow rather lower than the spinal column, by which the upper part of the curve will be inclined backwards to its natural axis. This is the most difficult part of the cure to accomplish, for the spine naturally advances forwards, in the part formed by the cervical vertebræ, to support the œsophagus, &c., and the appended weight of the head has a greater effect in preventing the reorganization of any absorbed portions of bone at the maximum point of pressure. However, this position of the head may be observed in bed at night time, during the growth of the body, in all which period, nature will unremittingly and unerringly exert herself to remedy the deformity, and supply deficiencies. In the cases in which palsy of the lower extremities has supervened, and begins to be removed, the position of the patient should be varied during the day, and he should be directed to turn on the back, and exercise the muscles of the lower extremities in every way he can, without fatigue or pain, in order to restore the strength and natural size of the muscles previously wasted.

It should have been observed, that, in the cases of excursion in which a lateral curvature has been eventually superadded, the lateral deviation is soon rectified, without any particular atten-

tion, by the observance of the facial horizontal position, extension, &c.

The recumbent posture recommended, is deemed indispensably necessary in many cases, but it will be materially aided in some by mechanical extension of the vertebræ, by occasional pressure on the outer line of curvature, and by the application of certain apparatus.

The benefits and effects of mechanical extension and pressure of the vertebræ may be partly illustrated in the following manner : although it will strike every body, the analogy between the condition of the spine and whalebone is not a strict one. Take an elastic substance, for instance, a piece of whalebone of the dimensions and figure of the spinal pyramid in its natural state ; bend it into a curved form, retain it in such, or increase the curvature gradually for some months : on removing the retaining power, employ extension by pulling at each end ; let pressure be simultaneously applied on the middle of the curve, and the bent whalebone will be forcibly reduced to a straight line. After a short period, remove the extending and compressing powers, and the curve will be re-established to a certain degree less than before by the elasticity of the whalebone : continue these powers for a long period, and it will remain nearly straight on their removal. To a certain extent, the same results follow the use of the same means in curvatures of the spine. In the incipient stage of distortion, the curve can be reduced by those powers to a straight line, and could be retained there, if the patient could bear their constant use, but this he cannot do ; in the advanced and confirmed stages, before an anchylosis has taken place, these powers, exerted in the degree easily bearable by the patient, are unequal to reduce the curve to a straight line at once, but, *gutta cavat lapidem*, in the course of time these powers greatly assist in accomplishing it.

When a portion of the spine becomes anchylosed through the whole surfaces of the diseased vertebræ, or in its posterior part only, its analogy to an elastic body ceases, for its elasticity and extensibility are lost, and it is so firmly fixed, that all efforts to alter its form would necessarily fail, and be as fruitless as they would be improper. Hence, one reason, why cases of many years duration are unalterable and incurable.

It seems proper to demonstrate the necessity of the *combination* of the mechanical means of extension and pressure, in order to produce the useful result of reducing the curved spine to its straight or spinal line.

An arch is a structure of cuneiform pieces of solid matter, that will stand as long as its abutments are firm ; a curved spine would therefore retain its form, and would have but little chance of making itself straight, unless aided by art.

If pressure be made on the key-stone, or centre of an arc, it only serves to confirm its strength, unless the abutments give way ; pressure, therefore, alone, on a curved spine, will not display any pow-

erful effects, or enable the surgeon to alter its form in any considerable degree. If, however, a power be applied to the extremes of an arc, by which the cuneiform pieces of matter can be separated from each other, and extended, and a strong mechanical weight be at the same time applied to the key-stone of the arc, the cuneiform ends on the concave line of curve will separate, and the whole will bend inwards, so as to approach a straight line and fall in; so it is in part with the curved spine, if pressure on the curve be employed in combination with extension of the extreme ends, it must be reduced more or less to a straight line, on each attempt, until, by a repetition of the process, this desirable end be in great part, or wholly accomplished. The analogy would be greater, and illustration clearer, if the mind suppose the arc to be formed partly of elastic and partly of incompressible matter, like the constituent parts of the spine; — the principle, however, would be the same.

The mode of employing extension and pressure has been somewhat varied. In the incipient stage, extension of the vertebral column may be employed as the patient lies on his bed, either by machinery made for the purpose, on the principle of a windlass, or by one assistant pulling at the lower extremities, whilst another pulls by grasping the wrists or under the axillæ; or, where assistants are wanting, the patient may pull with his hands grasping the bed-posts, whilst an assistant pulls the legs.

During this extension, pressure should be applied with the hand covered with a glove (or a compress may be laid between the hand and the skin), on each projecting spinous process individually, or on the whole at once. Or it may be applied to the transverse processes and ribs on each side, when the skin is tender over the spinous processes, or it may be employed alternately in both situations. In the advanced stages of excurvation, the patient has been generally placed on pillows laid on a table, between two of which a space has been left corresponding with a line drawn from the middle of the curvature, and, in this eligible position, extension and pressure have been used. These two mechanical powers have been generally employed as long and as firmly as the patient could endure it without fatigue or complaining of pain, and the power of the pressure in particular has been graduated by the feelings of the patient.

Extension and pressure may be repeated frequently during the day, without disturbing the apparatus to be applied, and to be presently described.

If relaxation and elongation of the spinal ligaments should hereafter be proved to exist, and to be the undoubted cause of curvature of the spine in any case, the extension above recommended would be injurious in such case, and should not be adopted. It is, however, a known fact, that extension is generally resorted to in the cases that fall under the treatment of the advocate of the doctrine of relaxation. It has been customary, in my practice, to desire

the parent or nurse of the patient to employ friction, shampooing, or percussion, alternately or in succession, about an hour before the intended professional visit, and consequently before the means last detailed. The friction has been made with the bare hand, a little flour being interposed between it and the skin, to prevent abrasion, or more commonly, lin. camph. has been used. The friction may be so contrived, as to make a gentle pressure available at the same time.

By friction, and the stimulus of the liniment, warmth and increased circulation are produced in the dorsal muscles and integuments, by which the muscular power is, by physiologists, said to be increased.

After friction, extension and pressure have been employed, the apparatus of a compress, a quilted pad, made of what ladies call wadding, covered with silk or cotton, and a shield placed over the curvature, and secured by a long, broad bandage, rolled round the thorax, should be applied, as the patient lies on the pillows, which is the most eligible method, or he must be raised on his knees and elbows, so as to form a space under him that will allow free liberty to pass the bandage with the hand:—The bandage should be rolled as much as possible during expiration, when the ribs are not distended or raised; because the bandage would be then firmer, and because the power of inspiration, by raising the ribs, would tighten the bandage on the projecting sternum and vertebræ, and has almost a natural means of mechanical pressure. Should inflammation of the vertebræ be present, attended with pain, or if the mechanical operations excite pain, in any degree, much complained of, they must be suspended or desisted from, until the inflammation has subsided, and the operations cease to occasion pain. The consideration of the utility of the remedies merely local reminds us of the delicacy of the subject, from the discrepancies of opinion that exist, relative to the use of issues and setons. I should evince an unjustifiable want of the respect and deference due to the facts left us by Mr. Pott, Sir J. Earle, &c., and to those accumulated and daily presented in public or private practice, were I to reject or undervalue the just inferences to be deduced from them. No one can reasonably doubt, that issues and setons have been most profitably employed; yet it is also certain, that in some cases, they have failed to be beneficial, and it is to be lamented, that the powerful minds of those great men had not been directed to establish a correct discrimination of the cases to which they were, with peculiar propriety, suited—or that Dr. Armstrong, or those who oppose the use of caustics in toto, had not attempted to limit them by a proper diagnosis.—See *Edinburgh Med. and Sur. Journal*, Oct. 1813, p. 397.

For experience has fully convinced me, that the indiscriminate and general use of issues and setons, which ensued on the publication of Mr. Pott's essay, may be dispensed with; because the cases in which they are not necessary, are more numerous than those in

which they are. They were in popular and *universal* employment in the hospitals, long after my introduction to the profession, in *all* cases of curvature of the spine; whilst the horizontal position was not deemed indispensable or even enjoined, and the patient was allowed to sit up or lie down in bed, as his inclination prompted. This was a singular oversight, as at that period of time rest, motionless rest, was enjoined in scrofulous inflammation and caries in all other joints, and no mechanical assistance in curvatures was resorted to, like that recommended in this Essay. It is feared that the profession still wants that precise degree of discrimination, which would enable it to establish a decisive rule of practice that would prove an unerring guide. Until experience has clearly laid it down, a suggestion may be hazarded, that the counter-irritation of setons and issues will be beneficial in the cases where scrofula is the occasional cause, during the period of scrofulous inflammation, ulceration, or caries. Where clusters of scrofulous glands have been inflamed, I have observed one cluster gradually diminished and become absorbed, as soon as suppuration has been established in another gland or cluster, in their vicinity. Mr. Ford thinks it checks external suppuration from the progress of caries.* It must, however, be admitted that the tendency of scrofulous action to continue in the structure it has once attacked, is so strong and undeviating, that we most generally fail in the attempts to withdraw and divert it to any other structure, by exciting artificial ulcerations; but although the action be not altered, the counter-irritation may often prevent the accessions of phlegmonous inflammation, which precedes scrofulous suppuration, and is often very destructive.

Of issues and setons, the latter, agreeably to Sir James Earle's opinion, will be found most convenient. They are also useful in cases of obstinate chronic inflammation, but truth obliges me to state, that scarcely a case has occurred in my practice, of late, in which the inflammation has not yielded to frequent topical bleeding by cupping and leeches; to successive blisters and rest; and these were generally adopted, because parents and patients objected to issues and setons.^a

In temporary curvature of the spine, from muscular debility, issues and setons have not proved beneficial. *See Mr. Baynton's cases, and the cases by Mr. H. Earle, in the paper already quoted.* It may be generally deduced, that they are not necessary, if the curvature depends upon progressive absorption from pressure.

Where disproportionate growth of bone in the bony bridge is the

^a [The editor has not found issues useful in cases even of a carious character; and believes that they not unfrequently cause hectic fever. Their removal has, in several cases, put an end to hectic irritation.]

* Loc. citato.

cause, they would probably be advantageous,* but the proposals for employing them in my practice have been hitherto overruled; the blisters I have used, in such cases, have been beneficial.

As the excursions of adults, more than of young and growing persons of all ages, so frequently arise from inflammation, and caries of the bodies of the vertebræ, or from the ulcerative or gangrenous destruction of the intervertebral cartilages, the counter-irritation of issues, setons, &c., is more generally indicated in their cases, and employed with more certain advantage. Although the use of the ancient remedy of issues (for it is traced to Hippocrates), frequently removes inflammation, ulceration and caries; yet Mr. Pott and Sir James Earle both state, with truth, that they cannot materially alter the curve already formed, nor is it possible that they should; but had they employed cautious pressure and extension, in conjunction with issues, the results of their practice would have been more successful and satisfactory.

If rheumatism be the cause, blisters, and ung. antimon. tart., are indicated: in scrofula they are sometimes troublesome, by producing scrofulous ulcers.

Upon the whole, of the two plans of treatment adopted by Mr. Pott, and Mr. Baynton, separately employed, which have divided public opinion, truth obliges me to confess, that I have witnessed more recoveries and speedier benefits from setons and issues, than from the use of the motionless dorsal horizontal position of Mr. Baynton. Of the two plans, conjointly employed, I have little experience, as they offered inconveniences almost amounting to incompatibility, which were removed by adopting the facial horizontal position.^a

Let us pass on at present, from the surgical and mechanical means, to the medical treatment. The latter will be chiefly directed to the re-establishment of the general health, or to its confirmation, and to the palliation or removal of particular symptoms that are distressing.

^a [Adults may be confined to a horizontal posture, but children are not able to bear it patiently. The latter find extension and exercise at the same time, by using the editor's spine-car, as figured and described in the 1st vol. N. Amer. Med. and Surg. Journ., published in 1826, and in Dr. Usher Parsons's judicious treatise on spinal diseases. — Ed.]

* The occasional occurrence, in young and growing persons, of an abscess and ulceration in the neighbourhood of bones, sometimes checks or suspends their growth, and, by analogy, may check any unnatural growth of bone. I have seen a case, where an abscess on the side, during youth, was, to all appearance, the cause of the ribs and bones of the vertebræ, on that side, being prevented from acquiring their full development and full growth, and a lateral curvature ensued. But in the adult, I have known ulcers to exist over the tibia, and about the knee-joint, for years, without diminishing the size of the subjacent bone. — See the *Effects of Abscess in a Guinea-Pig*, in Mr. Brodie, on the Joints, p. 179.

In the incipient stage of curvature from muscular debility, especially in children, chalybeates^a have been prescribed with much good effect, with an occasional laxative of pulv. rhei, twice a week. — In this stage, local cold bathing has been useful, by applying cold water, with a sponge to the back, during winter, and by cold affusion in the summer, provided there is no diathesis to pulmonic complaints, which would interdict its use. To recover or ensure the general health, the plainest diet, at regular intervals, should be enjoined, and yet the appetite preserved by a well-managed variety of simple food. The digestive organs are frequently deranged, and dyspepsia, obstipatio, and pain in the epigastric region prevail. The digestive functions have been strengthened, as well as the whole system, by obviating costiveness with rhubarb, or a combination of p. rhei, pil. hydr. et pulv. ipecac., and the exhibition of chalybeates, or the stomach bitters, with soda, or other alkalies. The peculiar pain across the epigastre sometimes require opium for its relief; this pain and screaming in sleep, I have known removed by occasional purgatives.^b

When the action of the kidneys is morbid, as may be inferred from the urine being scanty and turbid, and depositing lateritious sediments, it has commonly been restored to health by the use of magn. carb., sodæ carbon., with stomachics and gentle aperients.

The peculiar pain of the epigastre, nervous irritation, and irregular spasms, perhaps from the spinal nerves being somehow disordered, by the tortuous direction the spinal marrow is obliged to assume, have generally yielded to the above remedies, surgical and medical, as have also paralysis of the lower extremities and incontinence of urine. In paraplegia, friction on the skin, flexion, and extension of the limbs, and warmth, have been used in aid of the above treatment. The different pulmonic affections must be treated by the remedies ordinarily employed in asthma, pneumonia, and cough. It may be observed, that asthma sometimes induces general dropsy in a short time, with purple-coloured lips, cheeks, feet, &c.; and is frequently fatal to those whose spines and chests are much distorted. The milder attacks of asthma are sometimes greatly relieved by the vapour bath, used with the other remedies. The observance of the facial horizontal position diminishes the frequency of recurrence of asthmatic paroxysms, and combined with the use of the bandage, has the most decidedly good effect in relieving harassing dyspnœa. Scrofula must be

^a [No tonic is so useful in such cases, especially when scrofulous, as iodide of potassium or iodide of iron. I have often given, with good results, a powder composed of ten grains of phosphate of lime, five grains of phosphate of iron, and half a grain of iodide of potassium. — ED.]

^b [The late eminent surgeon, Dr. Physick, almost always followed Mr. Pott in recommending daily purging in his cases of curvature with caries. — ED.]

combated by appropriate remedies adapted to the different stages and symptoms of disease. In the inflammatory stage, frequent local bleeding, blisters, and setons, have been found useful during any accession or return of pain, with very slight alteratives at night, and a gentle hydragogue aperient in the morning, continued for a long period; when abscesses, or ulcerative absorption or caries are induced, and accompanied by emaciation, the bitters, sulph. acid. and cinchona, have their advantages.^a I have seen cases of curvature of the spine, in which scrofulous ulcers and abscesses of the joints of the extremities have been formed, and in which tonics and alteratives have proved highly beneficial, as well as the sulphuric acid. When the bladder loses its expulsive power the catheter must be used until it regains it.

The treatment recommended generally produces very beneficial effects on the state of the curvature, and of the general health in a month, indeed, the change in the condition of the curvature is more strikingly evident, during the first month, than subsequently. The corded tightness across the epigastre gradually subsides, dyspnœa is relieved, the appetite improves, the bowels become more regular, the biliary secretion more regular and healthy; the urine natural, and the power of retaining it and the fœces is gradually restored. Where paraplegia has existed, the returning motion of the muscles is, at first, involuntary and spasmodic, and attended with pain that generally occurs during the night. A degree of warmth returns, and is felt in the thighs and legs. The muscles soon become obedient to volition; the joints lose their rigidity; the sleep becomes refreshing; the mind cheerful, and the patient delights in the voluntary exercise of the muscles of the extremities, as he lies on his back, by which their strength is increased.

It appears to be of considerable moment to establish on some fixed data from principle or experience, the length of time the surgical and mechanical means should be persevered in, and more especially the period the recumbent posture should be observed; for it need hardly be repeated, how much the entire rest of the affected joints and the removal of pressure will contribute to the accomplishment of a recovery, or the arresting of the progress of disease.^b The length of time must necessarily vary, with the varying circumstances of each case, and be adapted to the different stages of the disease, the effects of remedies employed, and the powers as well as faults of the constitution.

^a [The effect of the use of a spine-car on the pain is curious.—The relief is so prompt and certain as to enable me to promise it after the suspension in the car for a very few days. It thereafter seldom returns.—ED.]

^b [Kissam's chair and Guérin's sectional bed have been presented to the public since the work of Bampfield was issued. Each has its advantages, but the simpler spine-car is equally useful and more convenient.—ED.]

In temporary curvature, before any particular spinous processes project unusually, one month will be often long enough to confine the patient to a strict observance of the treatment laid down, provided the dorsal muscles have, in the meantime, acquired sufficient strength to support the body in the erect attitude; but the change from the constant use of the recumbent posture to that of the erect attitude should be gradual, and the treatment should be divided between exercise in the erect attitude, gradually increased, and rest.^a

In the incipient stages of curvature attended with projection of some spinous processes, the rules laid down for position and the mechanical management, should be observed, a month or more after the spinous processes are restored to their spinal line, or within a quarter of an inch of it, for it frequently happens that that degree of projection remains for ever.

If only four or five vertebræ are involved in the curvature, and the case is not of long duration, or of a scrofulous nature, from three to six months will be required for the due observance of all the parts of the plan of treatment. When more are involved, or it appears clear from the admeasurement of the cord line of the arc or curve, that the bodies of some vertebræ must be wholly or in part absorbed, the length of time cannot be estimated or defined, as it will depend upon the regeneration of bone and the formation of perfect anchylosis; which are processes slow in completion. But the greatest obstacle to the accomplishment of a cure will be scrofulous diathesis, in the cases where it exists; for this and the destroying actions of ulceration and caries arising from it must be changed, worn out, or "deprived of their specific quality," before reparation by the deposition of new bone can commence with energy; and who can, with any degree of certainty, bound the duration of scrofulous diathesis, or circumscribe its action? Years may roll away; professional skill may be baffled and set at naught by scrofula, or with its utmost exertion and attention, it may only check its destroying tendencies until the constitution has wrought its own favourable changes, and vanquished it. After the devastating influence of scrofula has ceased, the regeneration of bone may proceed with indefinite slowness, or, perchance, of rapidity; then, during its regeneration and for a time allowed until it acquire a firm solidity, the patient should not venture on the erect attitude, for fear the injurious effects of motion and of superincumbent pressure should demolish their tender and brittle fabric. Every motion must tend to disunite the fragile anchylosis or bony union, newly organised and brittle; whilst undue weight and pres-

^a [Temporary curvature is almost always of the same nature as that treated of as lateral. When slight and not carious, it may be relieved by corsets studded with thin strips of whalebone, which give lateral support, and do not compress the chest and abdomen.—ED.]

sure may crush the little bony columns just formed and imperfect. These circumstances protract the cure, as the cases related by Mr. Baynton and others demonstrate, and as it has fallen to my lot to observe.

The excursions caused by rachitis, or a disproportionate growth of bone, are frequently of long duration, and sometimes not to be obviated; but the general effects of this cause of curvature will be noticed more particularly when speaking of lateral curvatures and angular projections. In excursions from this cause, the various modes of exercising the dorsal muscles may be employed without danger, and often with great benefit, as there is not much probability of exciting inflammation and producing its consequences.

When the destruction of the horizontal surfaces, or bodies of the vertebræ, has been produced by progressive absorption, although the regeneration of bone may have been prevented for years, by the patient remaining subject to the effects of pressure and of motion, by continuing to sit up and walk about; yet, soon after the patient is confined to the proper horizontal posture, by which rest is secured and weight taken off, the formation of new bone begins, and proceeds both anteriorly and posteriorly in the following manner, if it be allowed to deduce such an explanation of the arrangement from the observations made on the appearances presented on dissection. In the posterior portions of the vertebræ, the connecting ligaments of the spinous processes are successively converted into cartilage and bone, as are sometimes those of the oblique processes. Anteriorly, if the bodies of the vertebræ have been removed by progressive absorption, which generally leaves the anterior-spinal ligament entire, depositions of cellular fat (sometimes) and then of bony matter take place on the ligaments, which gradually increase, until they fill up the chasm formed between the remaining vertebræ, and become united to them, and, during this process, the ligament itself becomes ossified. When the horizontal surfaces only have been absorbed, and not the entire bodies, the formation of callus may ensue from the surfaces, and wholly fill up the chasm, provided all pressure be kept off and motion laid aside during its formation, as is done in cases of fractured bones, on the same principle of propriety and necessity. If the destruction have proceeded from caries, more particularly scrofulous caries, the perfect regeneration can seldom commence before the scrofulous action has ceased, and the spine is placed in a favouring situation; ossification also proceeds differently, for the vessels form granulations that become ossified from the surfaces of the bones, bounding the upper and lower part of the spinal chasm, which approximate, and by degrees consolidate, and produce a bony union. In some cases, any remaining intervertebral substance ossifies. — During the regeneration, pillars of bones are sometimes organised, which reach across the chasm in the anterior part, and which may have been primarily formed, to give incipient strength to protect the spine, during the succeeding and

more complete regeneration, or they may be formed afterwards to strengthen the anchylosis. These pillars have the appearance of being sometimes formed from the conversion, into bone, of some solitary shreds of ligaments that have escaped destruction.

However numerous the bodies of the vertebræ destroyed, and distantly separated the upper and lower remaining vertebræ may be, the chasm is filled up by one bony mass, and the vertebræ are not renewed as distinct bodies. When the surfaces only have been destroyed, the callus fills up the chasm, and something like distinctness of vertebræ remains. Mr. Burroughs inquires of Sir A. Cooper, in the *Edinburgh Med. and Surg. Journal*, for October, 1812, if the system of the recumbent posture, by keeping the back constantly extended, does not prevent, what Sir A. C. in his Lectures, calls the *necessary* curvature and the union of the bones.

It may be replied, that the recumbent posture and extension, and instruments are, in numerous cases, far from sufficient to reduce the curve of the spine into a straight line, as represented by Sir A. Cooper's diagram, sketched in Mr. B.'s paper, and that they offer no impediment to the cure by anchylosis, which is indispensable when the bodies of the vertebræ are in great part or wholly destroyed.

When the altered structure is remedied in the cures that do not terminate in anchylosis, and after anchylosis is formed in other cases, exercise of the dorsal muscles should be gradually resorted to and persevered in.

I shall take this opportunity of more fully considering the propriety of using active exercises of certain classes of muscles in spinal curvatures; of establishing the principle and describing the modes of their employment; and of pointing out the cases and periods in which they can be resorted to with advantage, or in which they should be avoided as injurious or dangerous.

In the particular species of curvature I have been considering, as well as in the others, active exercises of the muscles, situated on the posterior part of the trunk, and on the anterior parts of the thorax and neck, can be advantageously employed in the incipient stages of deformity, and in the advanced stages of recovery, when the disposition to disease is corrected, and the vertebræ are sufficiently firm to bear the superincumbent weight without injury, provided always there is no inflammation present of the vertebral joints. Where the cause of curvature proceeds from loss of power in the muscles, exercise proportioned to their strength will succeed, provided it be combined with much observance of the horizontal posture; for if, during this state of muscular debility, the patient is allowed to sit up and move about as he lists, the curvature will increase in spite of the best contrived exercises. When rickets or disproportionate growth of bone is the cause, active exercises are still more useful in the incipient stage, and never do injury, as the use of them in the rickety growth of other joints evinces, provided the latter cases are assisted by instruments, and

in the former, the patients should use contrivances to keep the spine erect, or often observe the recumbent posture. When mal-position has been the cause, active exercises and proper posture are decidedly useful. Exercise of the dorsal muscles may be generally employed with benefit, when the distortion is so slight, and the disease so little as to admit of the patient, by some effort, maintaining the spine perfectly erect, without pain, for a limited time.

When the patient is fast recovering from a state of curvature, by regeneration of the bone *after progressive absorption of it and the cartilage*, exercise cautiously and gradually increased will confirm the cure; but after every exercise the horizontal posture should be again resumed.

When caries or ulcerative absorption of the bone and cartilage has been the cause of curvature, the exercises which bend the spine or throw any weight on it, must be dispensed with, until the union by callus be perfect, and the bone is solid, otherwise there would be danger of fracture; for the ankylosis or bony union of the spinal column, after destruction of the vertebræ and cartilages, is not so strong as the column in its original state, being an exception to what occurs after the formation of callus in other bones, which become stronger at the point of callus. Experiments having proved that the strength of the vertebral column chiefly arises from the elasticity and strength of the intervertebral substance, which mainly unites them, and of which it is deprived by a bony union filling up the whole chasm formed both by destroyed bones and cartilage.

During active inflammation, or caries, or absorption of the spinal column, as during the regeneration of bone or formation of callus, the gymnastic methods of cure are so obviously inapplicable and disadvantageous, as to need no comment; if the gentlest exercise be attempted in the latter instances, it must be in positions in which there is no weight borne by the deranged parts of the vertebræ, as superincumbent weight and motion will necessarily destroy imperfect callus. Many ingenious modes of exercise have been recommended and employed by different authors and surgeons, who have directed their attention to the cure of distortions of the spine, and have written on the subject. These exercises are intended to influence the state of the curvature, and to remove it, on the principle that exercise of certain classes of muscles not only imparts solidity to the bones they move, but increases their own strength, so as to enable them to counteract unnatural deflections of the body, and cure incipient distortions. The different modes of exercise proposed by various ingenious authors, however varied in their mechanical application, all tend to the same object in curvatures, which is, to bring into action, more or less powerfully, the dorsal and thoracic muscles; or in the systematic language of anatomists, the four layers of muscles situated on the posterior part of the trunk; the two layers of muscles on the anterior part of the thorax, and the muscles situated between the ribs and on the anterior part of the neck; whose principal uses are to raise and maintain the

spine, the trunk of the body and head erect ; to move the scapulæ and clavicles ; to elevate and depress the ribs ; to perform the rotations of the arms, and to move them backwards and forwards ; and they tend to mould the trunk into its natural conformation, and conduce to the retention of all the above-mentioned parts of the frame in their proper situations.

These muscles can be exercised with or without the assistance of ingenious mechanical contrivances in the three attitudes of standing, sitting, or lying down.

In the erect attitude, the dorsal muscles can be exercised without mechanical aid, by bending the trunk backwards and forwards, simply, or with the object of picking up and laying something down on the floor before the patient ; or the patient may play or amuse himself with throwing or catching balls passed through two shoots, fastened to stands, one of which is higher than the patient, and the other is lowered near the floor. The patient stoops to catch the ball, rolled by an assistant, through the lower shoot, and then raises himself erect to roll it through the upper one.*

The arms may be employed in exercising the dorsal and thoracic muscles, that are inserted into the scapulæ, clavicles, and ossa brachii, by the actions of throwing them forwards, of drawing the shoulders and arms backwards, and by rotating them.

These muscles can also be exercised in the erect attitude of the body, with the assistance of mechanical contrivances, to give the exercises more power or better effect. To children, these exercises should be made a sort of play or pastime, and called games, so that they may amuse them, and cause them to be adopted with emulation, and without reluctance.

The expedient of carrying a light weight on the head, so as to cause some exertion of the muscles of the trunk in balancing it, to prevent it from falling off, and thus keeping the spine erect, in imitation of the milk-maids, was proposed by Mons. Andry, in his *Orthopædia*, published in 1723, and has been revived of late under the authority of Mr. Grant, of Bath, and of the late eminent lecturer and surgeon, Mr. Wilson. The modes described by both are the same in effect, and I will, therefore, describe Mr. Wilson's manner of using the weight. — "A small footstool, covered with a flat cushion, being inverted, may be placed on the patient's head, the hollow between the feet of the stool will allow of some substances, varying between four and ten pounds in weight, for it may be necessary to increase it to the last amount, although much less is generally sufficient, to be placed in it ; the patient should be instructed to raise this with both her arms, and support it on the crown of her head, elevating the spine at the same time towards the stool while held over her head ; she then, preserving the most erect attitude she can, should walk in a straight line as soldiers are taught to march, and for a time not exceeding ten minutes ; this should be repeated occasionally during the day. By degrees

* Dr. Dods on the Rotated or Contorted Spine, p. 218, fig. 3.

she will learn to balance the weight, and this occasional exertion, giving the muscles their true action, will straighten the spine much more effectually and sooner than any mechanical instruments.

“The patient should be frequently reminded by her attendants to sit upright, and the momentary attempt to do this, even if the attitude cannot be long persevered in, will prove useful in forwarding the recovery. Negro women and basket women, who, early in life, have been accustomed to carry heavy burthens on their heads, are never crooked.”*

This mode is often practised with benefit in incipient cases, when the curvature is slight, or depends upon rickets as a cause, and there is not much structural derangement; but, when the bodies of the vertebræ are reduced to a cuneiform shape, and their anterior portions are destroyed, the spinal muscles cannot much diminish the curve, or raise the vertebral column to the upright attitude. Heavy weights should not be employed, as such tend to cause an incurvation of the lumbar vertebræ, as is evinced in the attitude those porters assume who bear great weights on their heads; and if light weights are not carefully adjusted on a particular part of the head, the sterno-cleido-mastoidei, and the other muscles on the fore-part of the neck, are liable to be brought too much into action, and to become enlarged.†

In the erect attitude, the dorsal and thoracic muscles can be beneficially exercised in skipping, in playing at battle-door and shuttle-cock, in swinging by the arms with the head inclining backwards, in drawing up and down weights suspended to ropes or cords passed through pulleys.

Some machine makers, to whom deformed persons resort for their cure, suspend their patients by their necks, through the medium of ropes and compound pulleys, by which they presume they can straighten their spines; but, besides that the practice is dangerous in cases where the bodies of the vertebræ are carious or destroyed, it has more effect in stretching the ligaments and increasing the size of the muscles of the neck, which are principally called into action by the position, than it has in curing the deformity.

The exercises in the erect attitude are most available in and applicable to slight curvatures.

In the sitting posture, with the pelvis fixed, the muscles of the spine and chest can be brought into action, by bending the body backwards and forwards, and by taking up with both hands,

* Mr. Wilson explains the principle of action by the following illustration: —“If a finger is held up, and bent a little, a weight being placed on its tip, either will bend it completely, or oblige it to straighten itself so as to enable it to bear the weight when applied to it perpendicularly. Thus, the spine being bent in one or more directions, when a weight is added to the head, it directly and almost instinctively, by the actions of its muscles, straightens itself to bear that weight; and this action often renewed, and persevered in for a moderate time, will recover the spine from the bend that otherwise must have increased.

† See Mr. Shaw, on Distortions, p. 177.

at [the same time, weights placed at a certain distance before the patient, and lifting them up during the erection of the body; as also by imitating the movements of the arms in rowing, by rotating the arms and moving them backwards and forwards. Children can be induced to exercise the dorsal muscles by placing their playthings before them, which causes them to perform flexion and extension of the spine alternately.

Some ingenious methods of calling the muscles of the spine and chest into action, by mechanical contrivances, have been recommended and invented by Mr. Ward, and more especially by Mr. Shaw,* in their respective works. In Mr. Ward's method "a weight appended to a cord is passed over a pulley, and the other extremity, having a strap attached to it, is fastened round the patient's head; the pelvis being fixed, the patient is directed to raise the weight by drawing the head and trunk backwards, and to repeat this effort until fatigue be produced." After which the patient is advised to take rest.

A mode equally ingenious, and on the same principle as Mr. Ward's, is recommended by Mr. Shaw, of the application of which he has given a sketch in his seventh plate. "It consists of an upright rod, four or five feet high, and similar to the pole of a common fire-screen. In the upper part of the rod, a small wheel is placed, and about sixteen inches below the wheel, a lever eleven inches long is *let in*, and moves upon a pin; the opening in the rod being so cut as to permit the lever to rise and fall. To the end of the lever a certain weight is attached. This apparatus may be fixed by a small wooden vice to the table, directly opposite to the girl as she sits at her lesson, or at work. A riband, with a loop or ring in front, is to be put round her head; a silk cord is to be attached to the loop, and is then to be carried over the wheel in the rod, and to be fixed to the end of the lever, the cord being so adapted that when the girl is sitting quite erect, the lever is raised as high as possible. As long as she sits erect, the lever being kept up, there will scarcely be any weight dragging upon the head; but if she stoops or lets the spine fall to one side, then the cord is relaxed and the lever falls; and, by the consequent increase of the power of the weight, the force becomes considerable. To relieve herself from the constant pull, she is obliged to sit upright; and by the exertion to counteract the force of the weight when it falls low on the scale, the muscles by which the spine is naturally kept erect, are much strengthened. This instrument is very manageable; by moving the cord back upon the lever, the force or weight will be much increased, while by keeping the cord attached to the end of the lever, and moving back the weight, the force will be diminished. The adjoining plans will assist in the demonstration of the uses of the apparatus.

* See Mr. Shaw, on Distortions, p. 212 et seq., for many judicious contrivances.

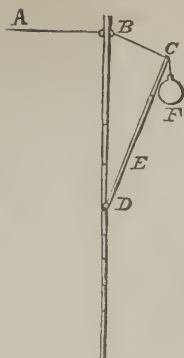


Fig. 1.

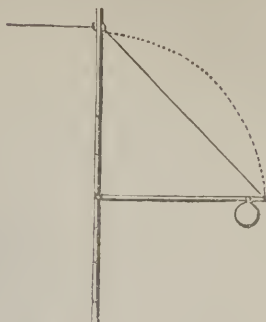


Fig. 2.

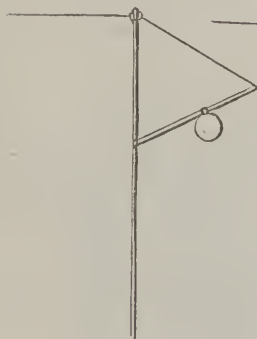


Fig. 3.

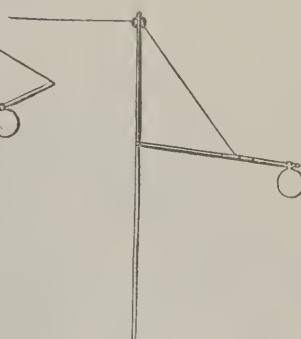


Fig. 4.

"The cord A passes over the pulley B, and is attached at C to the end of the lever E, which moves upon a pin in the upright rod at D. To the end of the lever the weight F, is hung. It is evident that as long as the lever is in the position of fig. 1, there will be little difficulty in supporting the weight by pulling upon the cord; but as the lever falls to the position in fig. 2, the force required will be in proportion to the distance it reaches down the scale. Without increasing the size of the weight, the force may be greatly augmented by moving the cord back upon the lever, as in fig. 4; and if we wish to diminish the force, it is only necessary to change the place of the weight, as in fig. 3."

Several varied exercises may be performed by the following addition to a couch. Let a couch be made with short bed-posts, and without any back or end boards; to one or both ends of the couch, let a standard or rod be fastened in the middle, of about five or six feet high. The standard should be made to take off and fix on by means of screw fastenings, or by being passed through brackets. Let one sheave or pulley be let into the upper part of the standard, and another lower down and much nearer to

the surface of the couch, through which, reeve or pass silken or hemp cords with hooks at one end to suspend weights upon, and with loops at the other, through which a round roller of wood, 24 inches long, may be passed for the hands to grasp. Let the patient take hold of this handle passed through the loop of each cord alternately, whilst he places his feet against the standard or a cross piece of wood at the bottom of the couch, and by pulling the weights up and letting them fall, he can perform flexion and extension of the spinal muscles by bending forwards the body and raising it, and can bring into action the muscles of the neck, by inclining the head backwards and forwards, whilst he at the same time exercises the muscles of the upper and lower extremities, and of those which move the scapulæ and clavicles; in fact, all the locomotive muscles of the body are called into action by this exercise. If the lower cord and pulley be employed, it enables the patient to stoop more forward. The muscles of the spine and neck alone can be exercised in the following manner without the aid of the arms. Let two bands of vellum be passed round the head, one horizontally, the other vertically; let a loop or hook be attached to the fore and back part of the horizontal band, let the cord of the upper pulley be attached to the back part, and the spinal and cervical muscles can be put into exertion by performing flexion and extension of the spinal column. Let the cord be fastened to the fore-part of the band, and the effect of the weight will be somewhat similar to Mr. Shaw's.

If to the sides of the couch, there be two rods of wood, with a leaden weight fixed or let in to their lower ends, made to move on an axle or pin, the muscles on the sides of the trunk and arms can be exercised with considerable force by pushing them forwards and drawing them backwards.

An apparatus called the Chest Dilator, but which exercises also the dorsal muscles, has been invented by Mr. E. Jukes, who has favoured me with the accompanying lithographic plates of it, and which can be employed on the same principle as the other mechanical contrivances in a varied mode. The following is his description of it:—

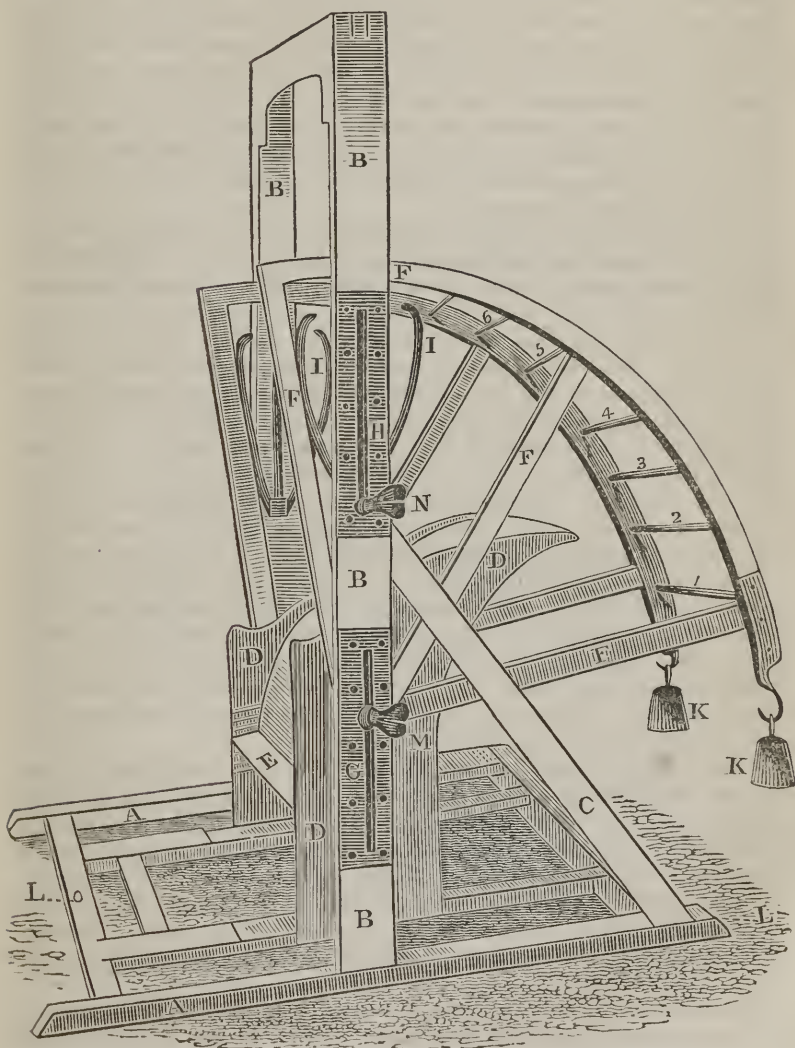
“The apparatus consists of a chair with a convex back, upon which the patient sits and reclines backwards, whilst he exercises a moveable quadrant rolling upon two pivots, fixed to a pillar on each side the chair. At the depending extremity of the quadrant two weights are appended, which allow it to be moved with greater or less effort, in proportion to their quantity, which is made to vary according to circumstances, or to suit the strength, age, and increasing capability of the patient, or any particular view of the practitioner.

“The references to the plate are as follow:—A, the frame. B, the supporting pillars. C, one of the braces. D, the chair. E, the moveable seat of the chair. F, the quadrant. G, iron plates for receiving the pivots of the quadrant. H, iron

plates for the springs. I, the coil springs. K, the weights. L, thumb-screws for screwing the frame to the floor. M, nuts at the axis of the quadrant. N, nuts for the coil springs. 1, 2, 3, 4, 5, 6, the connecting bars of the quadrant.

THE CHEST DILATOR.

(Invented by Mr. Edwd. Jukes, Surgeon.)



"To exercise this machine, the patient seats himself in the chair, and fixes himself firmly in his seat by placing his feet beneath the foot board; then reclining himself upon the convex back of the chair, which carries the body backwards, he stretches back his arms and grasps the furthestmost connecting bar of the quadrant that is within his reach, and makes an effort to pull the latter round upon its axis. If the strength used be sufficient to elevate the weights, the patient brings his arms to the perpendicular position, the quadrant rises and describes a circular motion equal to one half of its arc, and striking upon the recoil springs, its immediate retrocession is occasioned, and the patient's arms are brought, by the gravity of the weights, back to their original position. The patient again directs his efforts to bring the quadrant forward, when the same effects take place, and, in the continuation of these alternate motions, consists the use and applicability of the apparatus. The machine is constructed in such a manner, that every part is moveable, so as to be capable of being adapted to the stature and age of the patient.

"The anatomist will readily perceive, that in the use of this machine, the muscles moving the spine are put into a degree of action well suited to the pathological views of spinal derangement.

"The body reclines upon the chair, so that no task is imposed upon the spinal muscles of supporting the vertebral column, and this inclination of the spine backwards, proves serviceable in excurvation, by taking off all pressure from the anterior portions of the vertebræ, in a position that allows of some degree of exercise of the trunk and thorax, and approximates the spinous processes. In counteracting likewise distorted configurations of the chest, particularly that called 'chicken breast,' it is not less efficient; the arms are stretched backwards, and the spine extended upon the convexity of the chair, which necessarily brings the body into a state directly the reverse of that which accompanies this deformity, in which there is generally an inclination of the body forwards. The extension of the arms puts the pectoral and sterno-humeral muscles upon the stretch, brings the ribs outwards, and, whilst it lessens the projection of the sternum, increases the diameter of the thorax from side to side."

In advanced stages of excurvation, the spine could not be bent so as to recline upon this chair, and it is, therefore, not available in such cases. The principal action of the arms in this exercise is that of rotation of the shoulder joints, and consequently mostly exercises those muscles employed in their rotation.

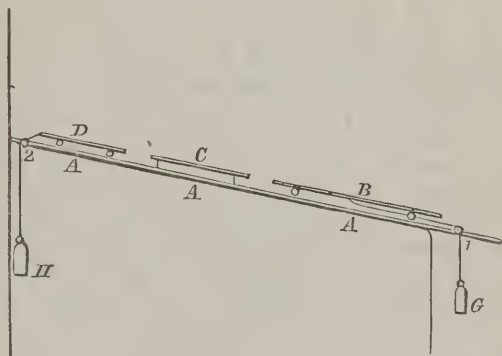
The stretching chair is employed on a wrong principle and its use is dangerous, as, like the rope and compound pulley, the crane and windlass are intended to stretch the spine by suspending the body by the head.

Exercise of the dorsal and thoracic muscles in the recumbent posture is more limited and less varied. In the facial horizon-

tal posture, the head can be moved up and down, which exercises the muscles of the neck and upper part of the spine, and if the feet be fastened to the foot of the couch, the hands can seize the couch posts or a pillar fixed for the purpose, and, by pulling the body upwards, stretch the spine and give employment to the muscles of the trunk. Children can be made to reach playthings before them. If the patient will direct his head backwards, he may raise himself on his elbows, which tends to throw the scapulæ backwards.

An ingenious mode of stretching the spine and of exercising the dorsal muscles whilst lying, has been invented by Mr. Shaw, of which the following is his description and diagram.

“Upon the moveable inclined plane A, A, A, there are placed three boards, B, C, D. C, which is to be very short, not more than ten inches long (it need not be on rollers); D, to be about twelve inches, upon which is to be fixed a cushion, or the socket that is generally used on the common inclined plane, for the head to lie in. This board is to be moveable. The patient lies on the three boards, the hips being on B, the shoulders on C, and the head on D; silk cords are to be brought from each side of the sofa-frame, and to be fixed to loops that are fastened behind and before to the patient's corset (without whalebone). The



weight G is to be attached to B, and the weight H to D. It is evident that the board B will fall in consequence of the heaviness of the body, and of its being pulled by the weight H. When it falls, the portion of the spine between the shoulders (which are fixed by cords), and the pelvis must be operated upon. The lumbar part of the spine is more effectually stretched in this way than it can be by a collar, or even by swinging the body; for the force acts gradually and constantly, which experience in the reduction of dislocations has proved to be the best way of operating upon muscles and ligaments. There is also another advantage attending this mode of stretching the spine; the muscles are not only

elongated, but at the same time strengthened by the patient instinctively using them, in opposition to the force acting against them. However, I do not trust to this instinctive action, but direct the patient to exert herself occasionally, so as to endeavour to pull the board B towards C.*

“The principal objection to stretching the spine, by the cord and pulley is, that the force operates chiefly on the cervical vertebræ. This objection is not applicable to the plan just proposed; for the loins can be stretched without the cervical vertebræ being affected. But as it is always necessary to stretch the portion of the spine above the shoulders, I have made provision for doing this, by means which neither hurt nor even annoy the patient. The head lies in the socket on the board D; to keep it steady, a ribband is brought from each side of the socket and under the chin. The board D being operated on by the weight H, is drawn separate from C, on which the shoulders rest: in this way, the cervical and upper dorsal portions of the spine are necessarily stretched.”

In the dorsal horizontal position, some muscles of the trunk and chest and those of the arms, can be exercised by pulling at the roller, passed through the loop of the upper cord of either standard, but that at the head of the couch will be most convenient and effectual, and the lower extremities can be exercised in drawing the legs up and down, with or without weights appended to them.

All the exercises described should be followed by intervals of complete rest. The case of H. Peckman clearly evinces that, the ordinary exercise of the muscles in incipient states of curvature from muscular debility, aided by country air, free exercise and good diet, will not arrest the progress of excurvation, and points out the necessity of establishing more vigorous exercises, of combining them with mechanical aid and contrivances, and of alternating them with the use of the recumbent posture. But whatever mode of exercise shall be instituted for a patient recovering from a state of vertebral disease, in which anchylosis has been a necessary consequence, it should be performed at first in the most gentle manner, and gradually increased in vigour and activity. In the incipient stages, if a recumbent posture be not constantly enjoined, during the periods unoccupied by appropriate exercises, the patient should avoid all malpositions of the body in sitting and walking, and should not continue either of those attitudes longer than he can carry his spine erect. As the exercises employed for the cure of any variety of deformity must be appropriate and well directed, to effect their desired object, their application should not be left to the indiscriminate choice of persons, unacquainted with the action of the several classes of muscles, and the causes and effects of spinal deformity, but should be always superintended by a surgeon, who has studied the subject.

* The boards should be covered with rough green cloth, to prevent them from slipping under the patient.

It is well known, that authors and surgeons are much divided in opinion, relative to the use of mechanical apparatus in spinal distortions, some trusting to them almost entirely for a cure, whilst others, as Mr. Wilson and Mr. Ward, altogether condemn their use. It may be observed that Mr. Pott disapproves of the use of spinal instruments in all cases of curvature, and that Sir James Earle recommends them when "well-adapted," because he had witnessed the good effects arising from their use, and wishes to obviate the disinclination of practitioners to their employment, derived from the opinion and writings of Mr. Pott. Regardless of the charge of being a trimmer, I shall endeavour to point out the advantages and disadvantages of their use, in the species of distortion under consideration, with a hope of settling the discordances of sentiment, or at all events of establishing something like data or rules to direct the judgment, and I shall revert to the subject in treating of lateral curvature which so much more frequently arises from rickets, about their employment in which, the differences of opinion have chiefly arisen, or have been the greatest.

The instruments and mechanical apparatus invented, have been applied to different purposes. Those for exercising the muscles have been considered at some length. Other mechanical contrivances and apparatus are calculated to answer the following objects. To stretch the spine, and thereby assist in straightening it where it is curved; to open or widen the spaces between the bodies of the diseased or deranged vertebræ; to keep the spine extended; to prevent its deflection from the upright attitude to any curve or malposition; and by these means to aid in preventing distortion or to assist in its cure. These mechanical apparatus are constructed to promote or attain these objects in the different positions of standing, sitting, or lying on an horizontal surface, or an inclined plane, some being calculated for use in all those positions, and others in only one; whilst one is only adapted and applicable to one purpose, and another to one or more purposes. The instruments are either employed temporary, as, for instance, with a view to allow the patient to sit up or walk about for a limited time, or they have been worn constantly, so that their action became permanent. The instruments used in the erect and sitting postures, are, swings for the arms or head; a chair with moveable arms as axillary supports, and a curved steel bar fastened to its back, and projecting over the head with steel bows suspended to it, that traverse on a pivot or swivel, with bands or straps to pass under the chin, or under the chin and occiput, to bear the weight of the head and occasionally suspend the body.* The instrument commonly known by the name of collar, is a spinal machine that might be more properly called a spine supporter, and is one with which the profession is familiarly acquainted in some form or other, for there are many different forms

* Darwin's *Zoonomia*, vol. iii., p. 140.

or modifications of it. The first was made by Mr. Le Vacher, *Memoirs de l'Academie de Chirurgie*, vol. iii., p. 600, but the curved steel bar of his machine was not moveable by the use of the joints at the back, by which it could be elevated or depressed. Mr. Jones thought that he had improved on Mr. Le Vacher's instrument, by substituting a forked bar for the curved one of Mr. Le Vacher, covered with vellum or a web, which passed from behind the ears under the maxillæ, to support the head and prevent a forward inclination of it.

Of late, the collars or spine supporters are made nearly alike in principle and application, but with different degrees of neatness and ponderosity, and with some little difference of effect. It would be occupying the time of the reader unnecessarily, to describe more than an outline of one, which is simple and the least ponderous. It consists of a back-plate of iron which covers the shoulders, and has leather straps to pass over the shoulder joints, of a circular hoop of iron, which encircles the pelvis, and which is fixed by a leather strap and buckle over the pubis, or it is made with pads and springs to grasp the spine of the ileum; of upright bars to unite them; and of a rod to support the head. The back-plate and circular hoop are united either by one rod of iron, passing along the centre of the spine, or by two light ones which pass on each side of the spinous processes; to the back-plate are affixed two axillary supports, or moveable crutches that pass under the arm-pits, and either the curved or forked steel rod or bar, that passes over the head or under the chin, is fastened to the back-plate, by joints, which do not admit of motion, or the lower end of it is received in a hole or socket of the upright back rod, which allows it to traverse with the motions of the head. The forked rod generally traverses on a pivot. Some spine instruments have a strong elastic steel plate on the side, to press on the projecting ribs in lateral curvature. Some are made without a back-plate, and have, instead of it, another circular hoop, that passes round the trunk in a line with the axillæ, where crutches are formed for their support. These have two lateral connecting bars, and the whole are made light. Some are made to allow the arch of the instrument to fall back.

In constructing collars, one object should be to make them light; which is not the case with the Hinckley collar and many others. The collar with two back rods is preferable in excoriation, as that with one necessarily presses on the projecting vertebræ, and occasions pain and sometimes ulceration. Those, made with back-plates, and springs and pads to seize the spines of the ossa illi, and subject them to superincumbent weight, do not appear to me to be so light and comfortable, as those with circular hoops and straps, which have no particular injurious effect by occasioning unnatural pressure, as do the former. The collars with steel rods for the support of the head, that traverse, after Mr. Portal's plan, are preferable to those that are fixed, as they allow of some motion to the muscles of the neck. The straps, fastened to the curved steel rod that passes over the head for suspending it,

occasion much pressure on the maxillæ and cheeks, by which these bones, in a growing person may be distorted or their natural growth and form prevented, and the muscles of the cheek may, by this pressure, become partly absorbed, and the features deformed. The pressure of the ponderous collars on the hips and shoulders, also occasions absorption of the soft parts and muscles in those situations. Hence it is, the forked collar is preferable to the curved, as it does not occasion any pressure on the cheeks and but little on the chin.

The following is the mode of applying the collar. The trunk part of the collar being firmly fixed on the pelvis and shoulders, the patient stands under a stretching apparatus; the vellum bands or straps hooked on the bow of the head-piece, are placed under the chin and occiput; the body is then fitted up, and spinal column stretched by means of a cord and pulley attached to the head-piece, and when it is sufficiently extended, the steel bar or rod is fixed and retains the trunk of the body almost immoveable in that position, so that the whole weight of it is borne by the bands already mentioned, which necessarily press hard against the chin and cheeks. With this instrument, the patient may walk and sit, without much superincumbent weight being thrown on the vertebræ, but it is properly objected to its use, that it keeps the muscles of the trunk and spine in total inaction, if constantly worn, although it keeps the spine extended.

In the erect state of the body, the spine can be stretched by swinging by the head or by the hands. These two modes act upon different portions of the spine with greater or less effect. If it be the intention to extend the lower half of the spinal column, swinging by the hands with weights affixed or appended to the feet, will more particularly act upon it, whilst it will not produce the same effect upon the upper half of the spinal column, which, however, could be acted upon by moving the head backwards and forwards, or by inclining it backwards. If it be the intention to stretch the upper half of the spinal column, swinging by the head will more particularly effect it, whilst the weight of the lower extremities will also extend the lower vertebræ in some degree.

The chair with a small seat, and a back that is upright or a little inclined forwards, is recommended by some to keep the spine erect, and has been called the Cowper chair, I suppose, without the sanction of that eminent surgeon Sir Astley, as it only deserves to be mentioned, that a caveat against its use might be enforced: for it gives no support to the back, and the young lady or person sitting on it, after the endurance of an uneasy seat for a longer or shorter time, seeks relief of the spinal muscles, either by inclining to one side or stooping forwards.^a

^a [The seats in schools, especially for girls, should be made with backs of an easy inclination, so as to afford rest to the spine when the erect posture ceases to be maintained without undue effort, and the girl is wearied. — ED.]

In the lying or horizontal posture, the spine can be stretched by means of two assistants, one of whom grasps the lower extremities, and the other the upper extremities, or places his hands under the armpits, and thus gradually extend the spine; should, however, the cervical and upper dorsal vertebræ be implicated, one assistant may pull gently after grasping the chin and head. In the recumbent posture, the spine may be also stretched by a sort of windlass. In this case, the straps of the collar are fastened round the head to fix it, and the chin supported upon a small pillow, whilst cords attached to the windlass at the foot of the couch, are fastened round the ankles defended from the effects of pressure by being encircled in thick leather, and, in this state, extension of the spine is put in force. In both modes of extending the spine, the patient must lie in the facial horizontal position. By neither mode is the extension made permanent, but is resorted to as often as may be enjoined by the attending surgeon, or as the patient may feel disposed to bear, for it can seldom be continued beyond half an hour without fatigue and uneasiness.

The illustrious Dr. E. Darwin, whose penetrating and comprehensive mind allowed no department of the medical sciences to escape his investigation, many subjects of which he improved by his powerful genius, has invented a mode "to extend the spine and diminish its curvature by the weight and position of the body." "For this purpose," he says, "I have made a steel bow, which receives the head longitudinally from the forehead to the occiput; having a fork furnished with a web to sustain the chin, and another to support the occiput. The summit of the bow is fixed by a swivel to a board going behind the head of the bed above the pillow. The bed is to be inclined from the head to the feet, about twelve or sixteen inches. Hence the patient would be constantly sliding down during sleep, unless supported by this bow, with webbed forks, covered also with fur, placed beneath the chin and occiput. There are also proper webs lined with fur for the hands to take hold of occasionally, and also to go under the arms. By these means, I should hope great advantage from gradually extending the spine during the inactivity of the muscles of the back, and that it may be done without disturbing the sleep of the patient; but if this should happen, the bow is made to open by a joint at the summit of it, so as to be instantly disengaged from the neck by the hand of the wearer." — *Zoon.*, vol. iii., p. 141. A weight occasionally fastened to the feet would give more extending effect to this mechanical contrivance. The objections I have made to the use of the inclined plane, do not apply to this modification of it; for as the head is fixed, no weight or pressure is imposed on the spine by its employment.

A mechanical support to the spine to prevent it from being bent, when the patient is in bed, is not necessary in excurvation, provided the facial horizontal posture be observed, but in this and all other positions, my patients have worn the pad, shield and bandage, without inconvenience and with certain benefit. Among the me-

chanical contrivances, a dosser of lead, or a bag of sand or shot may be mentioned, as in the facial horizontal position, they may be laid over the projections in many cases, and produce constant pressure, with advantage, and, at least, without any injurious tendency. The mechanical apparatus for the double purpose of exercising the spinal muscles, and of stretching the spine, in the recumbent posture on an inclined plane, has been already described. Among the mechanical apparatus, the "friction roller" for rubbing the spinal muscles, may be mentioned as a more efficacious mode of using friction, than rubbing with the hand.

In adverting again, to the differences of opinion, which have existed respecting the utility and propriety of employing mechanical apparatus for the cure and prevention of distortion, I would first observe, that they should not be trusted to alone in any case, as is too much the practice, where the patients apply to machinists who are not surgeons, or where the surgeons consulted have not turned their attention to the subject and refer the patients to machinists; but the mechanical apparatus of some form or other, can be employed, with advantage, in some stages of the complaint, provided their use only constitutes a part of the treatment, and is combined with such other means, as have been described and recommended in the different stages of the disease.

I so far coincide with those who oppose the use of instruments, in believing them to be unnecessary and useless, in those stages of spinal disease in which I have stated the use of the horizontal posture to be indispensably requisite; indeed, when circumstances or symptoms render that posture advisable, the use of instruments is improper, and if employed as a substitute for it, the practice would be highly censurable, for no instrument or combination of instruments could so effectually relieve the spine from superincumbent weight and pressure, as proper horizontal position; as well might the surgeon, in a case of scrofulous inflammation of the knee-joint, put on an instrument to restrain its motion, and desire the patient to walk about on it! The use of instruments, for instance of the collar, will not relieve the disordered respiration, whether dyspnœa or asthma; their use will not prevent the accession of fits or chorea; neither will they conduce to the cure of paraplegia, nor remove the sense of corded tightness across the epigastre, so effectually, as proper recumbent posture, and, indeed, they frequently fail in those objects entirely, and the patient gets worse under the use of the collar.

Instruments for stretching and supporting the vertebral column, should not be employed during scrofulous or simple inflammation, or caries, or vertebral destruction by absorption, neither should they be resorted to during the regeneration of bone. During inflammation, the stretching of the ligaments would irritate and probably increase it, and the support from the collar would not be effectual in taking off all superincumbent weight and pressure. During, or after extensive destruction from ulcerative or progres-

sive absorption, the remains of the vertebræ might be fractured by forcible stretching even by the windlass, and much more likely by the mode of stretching the spine by suspension by the head.

During infancy, I have not employed powerful extension in the cure of excurvations, or any other form of curvature, and have consequently avoided all the mechanical apparatus for stretching the spine, and have never used the collar for its support, as I was apprehensive, at that tender age, of doing injury by straining muscles or dislocating joints; nor is such a practice necessary, as the numerous excurvations at that age are cured with greater facility than at any other. Indeed, the use of the pad and bandage well applied, in union sometimes with the shield, assisted by tonic medicines, the cold bath, and attention to the digestive functions and excretions, generally effect a perfect cure in twelve months, without the aid of instruments.

The collar may be worn, or the chair, with axillary supports, and the curved or forked bar behind to maintain the head and spine erect, may be used in the incipient stages of diseases, arising from rickets or malformation, habits of malposition, and debility of the dorsal muscles, during such periods of time, as the patient would otherwise sit or walk about, but the collar should not be used constantly, neither should the patient constantly sit in the chair; in such cases, their use should be alternated with such appropriate exercises, with or without mechanical contrivances, as have been described, and with horizontal rest after fatigue has been induced by them. When the use of the imperfect erect attitude in sitting and walking is improperly adhered to, from the false humanity and indulgence of parents, or from the obstinacy of children, or the folly of those of mature age, the collar should be recommended as the least of two evils, and should only be put off, when the patient can be persuaded to pass his time in appropriate exercises, or in observing the recumbent posture. Should the presence of scrofulous inflammation, or caries, &c., render exercise improper, the collar should be constantly used by such ill-fated patients, as will adhere to the use of the erect attitude, except in bed, where they may be frequently persuaded to observe the facial horizontal position. The use of Dr. Darwin's steel bow for the head in conjunction with the inclined plane, is generally applicable, and does not admit of any serious objection, provided the inclined be lowered to the horizontal plane when the bow is cast off.

In the early stages of disease, if the progress of distortion be not arrested by the use of the collar or chair, alternated with exercise, they should be abandoned, and the patient should have recourse to the recumbent posture.

After the proper spinal line has been restored by the means recommended in this Essay, and the convalescent begins to sit up and walk about, I have found the collar or spine supporter useful and beneficial, in combination with moderate exercise without it,—by assisting the muscles to maintain an erect attitude; by prevent-

ing the patient from stooping forwards or falling into any malposition, and in so doing, by taking off pressure from the anterior portions of the vertebræ or the intervertebral cartilages, which have been the seat of disease or of derangement.

Some silly parents are contented with a partial removal of the excurvation, particularly with that degree of it which has been arrived at in cases where paraplegia had been induced, and the use of the lower extremities has been restored; in such cases, they are so much rejoiced to see their children on their legs, that they will not persevere in the use of the recumbent posture, and the surgeon's only alternative is to recommend the use of the collar, which, in my experience, has not as yet enabled me to make the cure perfect. The same rule of practice applies to unruly adults. Should any projection of any vertebræ remain (as is frequently the case), after the spine can firmly preserve the erect attitude without risk or inconvenience, the patient should be enjoined to observe the horizontal posture at the periods he would otherwise sit; he should be also directed to wear the spine instrument if he assume the erect attitude, unless for the purpose of exercising the dorsal muscles; and by these means, he would facilitate the labours of nature, that is eternally engaged and is often successful, during the growth of the body, in remedying all deviations from its perfect form.

When recovery is advancing, the patient may gradually accustom the spine to bear the superincumbent weight of the head and body, by gradually and temporary changing the use of the horizontal, to that of the inclined plane, which could be progressively raised higher so as to increase its angle of inclination, until it became almost vertical. The curved or forked bar for supporting the head may be gradually laid aside, whilst the trunk parts of the collar are continued, by which arrangement a considerable degree of motion will be allowed to the spinal muscles, particularly those situated on the upper part of the column.

It has been objected to the employment of the recumbent posture, that it very often causes great and distressing dyspepsia,* and that this objection may be sometimes made with truth to the use of the dorsal position, I have had opportunities of witnessing. I have, however, much pleasure in stating, that dyspepsia has not, in any case as yet, resulted from observing the facial horizontal position, but that the latter has always conduced to its removal, where it has existed. More serious objections have been of late made to the continued use of the recumbent posture, as well as to the constant employment of the collar, or any mechanical apparatus, that wholly prevents the ordinary actions of the spine; for it is affirmed, that the inaction of the spinal muscles, resulting from the use of instruments and the recumbent posture, produces a withering, as well as utter debility of those muscles, and whose

* Ward's Practical Observations on the Spine, &c., p. 45.

exercise, as of muscles in general, is said to be necessary to their organic preservation. It appears to me that the application of this principle has been carried to a greater extent than general experience will justify, and in treating of lateral curvature, I shall take an opportunity of urging the arguments against its universal applicability.

It may be here enquired, if the vertebral column be *always* restored, by the great variety of means enumerated, to its spinal line, its natural form and powers? It may be answered, that this desirable effect should always be the aim and object, but is not always the end and result. It is generally accomplished in incipient cases, in temporary curvatures, and where there is not much destruction of the bodies of the vertebræ or their cartilages, or great disproportion of the growth, or malformation of bone; but where there is considerable vertebral destruction, or the curvature is of long duration, or the disproportion of the parts of the vertebræ is great, either from malformation or diseased alteration of structure, the perfect restitution is impossible, and the patient must be resigned to the imperfect degree of uprightness his situation admits of being restored to. I cannot, however, resist observing, with much regret, that many parents and persons are too easily satisfied with a limited amendment, and, if life be safe, will not persevere in the means of obtaining a more perfect recovery, when in the power of art to accomplish it. Few of the lower orders are to be met with, who have sense and firmness to enforce upon their children the due observance of the proper horizontal posture; many cannot devote the necessary time to watch over the movements of their children and prevent them from committing improprieties; whilst very many are unable to raise funds sufficient to purchase the mechanical apparatus, at the enormous prices machinists charge for them, and are, by poverty, deprived of the adequate means of recovery.

CHAPTER VI.

INCURVATION OF THE SPINE.

SECT. I. — *History and Symptoms of Incurvation.*

INCURVATIONS of the Spine are less frequent than the other species, and do not describe such large curves as they exhibit.

Incurvations are rarely attended with the serious consequences that ensue from the other curvatures, and will only require a brief notice. It generally, perhaps, always takes place in the cervical, lumbar, or lower dorsal vertebra, from disease. By some rare accident, a power may be applied to some dorsal vertebra, which

shall force them from their natural axis, into a state of incurvation, as is said to have happened to Colonel Sibthorpe. — *Medical and Physical Journal, for March, 1823.*

I have not seen incurvation of the lower portion of the spine produce any remarkable derangement of the nervous system or influence, but it has generally been accompanied with lameness of one extremity or psoas abscess. The incurvation is formed by a gradual and regular bend inwards of the vertebræ affected, presenting an appearance called *hollow-backed*, and dissection displays such vertebræ of a greater thickness on the anterior, than the posterior parts of their bodies. In the lumbar and lower dorsal situations, it is sometimes caused by the gradual contraction of the flexor muscles of the thigh, induced during the existence of lumbar or psoas abscess, for the patients so affected are almost sure to assume and indulge in the bent position of the thigh; or this position may be involuntary, and the contraction the pure effect of disease; in either case, the contraction draws the vertebræ inwards (more particularly when the weight of the extremity is depending from the muscles), and the thigh upwards, so that, in truth, the muscular contraction should be regarded as the primitive disease in those instances, and the incurvation as an effect. Lumbar incurvation sometimes arises from carrying very heavy weights on the head, or suspended from the neck. One extremity becoming shorter from diseased hip-joint, has also led to this incurvation. It has also arisen from an increased and disproportionate growth of the anterior portions of the bodies of the vertebræ. The cervical incurvation is sometimes caused by large heads inclining backwards, and chiefly produces inconvenience and disorder by its pressure on the œsophagus, rendering deglutition difficult, and extending to the trachea so as to affect respiration in some degree. It is also occasioned by rickets.

Mr. Field, the learned Register of the Medical Society of London, did me the favour to show me a case of very extensive cervical incurvation, in which the occiput, from the incurvation, approached the first dorsal vertebra so close in the erect attitude, that the forefinger or its breadth only could be laid in the intervening space, which of course diminished the height of its stature, and made it appear stunted in growth. The child was rickety, pallid, dyspeptic, and much distressed with dyspnœa, and yet its mother refused to submit it to a proper surgical treatment.

The lumbar incurvation is, in general, temporary, or removable at will, the cervical is permanent. Unless the contraction of the flexor muscles of the thigh can be overcome, and it is frequently insuperable, the lumbar incurvation is observable, when the patient walks or stands, and the flexor muscles are stretched by the weight of the extremity and putting the foot to the ground; many such persons are seen walking the streets of London.

It may be supposed this distortion when combined with lumbar abscess could not be mistaken; but it is proper to mention, it has

been. Miss Wright, 27, Warren-Street, had been long affected with lumbar abscess on the left side (which was still discharging), and incurvation accompanied with lameness, and on being visited by a physician practising in spinal diseases, he pronounced the incurvation to be the effect of distorted vertebræ, which caused the lumbar abscess, the contraction of the flexor muscles and lameness, and the apparatus of shields, pads and swaithes was directed. I was subsequently requested to see her with Dr. Hutchinson, and no difficulty was found in demonstrating that the vertebral column could be restored to, and retained in its spinal line by position only; for, by laying the patient on her back with the extremity extended, the loins formed an arch over the mattress, under which the arm could be passed, but on bending the thigh on the body, the lumbar part of the vertebra gradually approached, and at length, lay close on the mattress; by sitting upright with the thigh similarly bent, the spine also became straight. All mechanical apparatus was of course discontinued. The psoas abscess got well, but the temporary incurvation continued, in the extended posture of the lower extremity. The difference in the anatomical structure of the posterior and anterior portions of the vertebræ, will account for the circumstance of incurvations seldom obtaining so extensive a curvature as the excurvations. for the substance of the processes is considerably stronger and firmer, and has a thicker external plate than the bodies of the vertebræ themselves, and is less liable to ulcerative and progressive absorption, and will also explain why incurvations occur more frequently in the cervical and lumbar vertebræ than in the dorsal; for the spinous processes in the latter, oppose a greater resistance by their closer apposition than in the former, where they are more distantly separated.

In their natural state, the intervertebral substances yield readily to compression, and allow the spinal column to bend forwards much more than the oblique and spinous processes do backwards, although the power of youthful habit and training, exemplified in tumblers, can accomplish much in increasing the ability of bending backwards, without displacing any of the vertebræ.

SECT. II. — *Treatment.*

In all cases of incurvation, the dorsal horizontal position is the most proper; if the incurvation be of the cervical vertebræ, the chin should be drawn in towards the neck, which tends to throw the cervical vertebræ backwards; if of the loins, the flexion of the thighs tends to remove it, but this flexion should not be constantly employed, as it would dispose the flexor muscles of the thigh to establish a permanent contraction.

Where the incurvation is situated in the cervical vertebræ the apparatus of bandage, &c., cannot be applied around the neck with any effect, because it would compress the trachea, &c., but a gen-

the extension can be employed with advantage, as well as a moderate degree of pressure on the sides of the neck directed backwards. The extension used may be temporary and often renewed, or it may be long continued or rendered *permanent*. Temporary extension may be made by two assistants, one of whom should lay hold of the head, and the other the hips or legs, or should press on the shoulders, and, by gently drawing in opposite directions, produce extension of the incurvated cervical vertebræ. This mode of extension may be often renewed. The extension may be long-continued by the use of the collar, or of Dr. Darwin's steel bow crossing the head longitudinally, whilst the patient lies on the inclined plane. If this or the collar could be constantly worn, they would necessarily produce permanent extension.

Proper position will also contribute to the recovery, by taking off the superincumbent weight and pressure of the head, and by assisting in keeping the cervical vertebræ extended. For these purposes, the patient should have his head fixed in a socket let into the plane in which he lies, with his chin bent on the chest, and extension of the cervical vertebræ should be resorted to, immediately before the occiput is placed in the socket; the plane should also have a slight angle of inclination at first, that may be afterwards increased. — For, the head being fixed, its weight does not press on the vertebræ, even when the patient lies on an inclined plane. Friction and shampooing should be employed. Leeches and blisters may be prescribed, if any pain or inflammation arise. Appropriate remedies should be adapted to the different constitutional disorders that may accompany incurvation, similar to what have been recommended in excurvation. Tonics are, in general, indicated.

In the cases of spinal curvature in which the dorsal horizontal position is adopted, the patient should lie on an unyielding mattress, for, if placed on a yielding medium, the column would curve backwards beyond its true spinal line. To this rule, there are some exceptions.

It may be proper to observe in this place, that the species of temporary incurvation of the lumbar vertebræ occurring during the existence of psoas or hip-joint abscess, may be sometimes prevented by resisting the tendency to a permanent contraction of the flexor muscles. This is to be attempted, by confining the patient to the horizontal posture, and keeping the lower extremity, on the side affected, extended by mechanical means, if necessary, if he lie on his back; but if he lie on his face, the flexor muscles of the thigh will be extended, in a great degree, by position and the weight of the body and extremity.

But it is to be regretted that many children fret and cry, and oppose this recumbent plan so effectually, that it cannot be carried into execution, and the object of the surgeon and parents is frustrated. I have seen contractions of various muscles induced in many cases from different causes, all of which eventually yielded

to mechanical extension, friction, exercise, and the warm bath or fomentation; but I have not yet seen a case where a contraction of the flexor muscles of the thigh, of *long duration*, has been overcome by those means; a fact which forcibly shows the importance of prevention, as the contraction causes permanent lameness and disfigurement.

When the dorsal vertebræ have been forced inwards by accident, without producing fracture or complete luxation, symptoms of pressure on the medulla spinalis and of nervous irritation may arise, bearing some resemblance to those proceeding from excurvation; thus, the upper and lower extremities become partially paralytic, their sense of feeling becomes diminished as well as of other parts, deriving their nervous influence from the dorsal nerves, and the animal heat is defectively generated. The general health suffers and the patient is subject to consipation and headache.

When this accident occurs, the dorsal position should be observed with the head raised, and thighs drawn up towards the abdomen, and the patient should lie on a soft feather-bed in preference to a mattress, as, to this position, the spine would project more backwards or outwards, than in any other position of the body, and the soft and yielding medium of a feather-bed would allow the spine to bend outwards to the greatest extent position would cause and allow of.

Extension of the spine, in the manner already described in excurvations, should be frequently employed, and pressure should at the same time be made on the sides of the ribs, by which the vertebræ would be directed backwards by the ribs as by a lever. The principle on which lateral pressure is directed in such cases is the same as that by which I illustrated thoracic deformity in excurvation.

If pressure be applied to two opposite points of a figure, nearly circular, formed of elastic or compressible matter, it will be reduced from the circular to the oval shape; so, by pressing on the sides of the thorax, the spine and sternum would be caused to protrude a little in the opposite direction, and by pressing on the sternum and spine, the chest would be flattened and the ribs made to project a little laterally. If this principle be correct, and experiment will prove it, the pressure made in Colonel Sibthorpe's case on the sternal extremities of the ribs, could not have contributed to the replacement of the vertebræ, which was more probably accomplished by the extension and dorsal position employed. If incurvation of the dorsal vertebræ should occur from any other cause than accident, the same principles of treatment will apply.

CHAPTER VII.

L A T E R A L C U R V A T U R E .

SECT. I. — *History and Progress of the Symptoms.*

THE spine sometimes assumes some degree of lateral curvature, in the advanced stages of excurvations, either from caries spreading in an irregular manner on one side of the vertebræ from the anterior portions, or from the patient habitually inclining his weight on one side, and producing some degree of lateral absorption; but as this casual deviation soon yields, in general, to the means of cure employed for the excurvation of the spine, with which it is combined, it is not my purpose to notice this variety further, and I shall at once proceed to the description of the idiopathic disease.

This disease almost universally occurs *during the growth of the body*, and is almost as common as excurvation. It rarely occurs in infancy or after the adult age.

It has been remarked by Mr. Ward, p. 25, that the curvature takes place more frequently towards the right side than the left: as my experience is the reverse of this statement, it is probable both sides are equally liable to it, that is, *to the first or dorsal curvature*,^a — for lateral curvatures are single, double, or triple; and in the latter cases are ambilateral.

The first deviations of the spine from its natural axis to an inclination to either side, are seldom observed, and the first symptom that frequently awakens the attention, and alarms the apprehension of the parents of children and young persons, is the elevation of one of the shoulders; or the depression of the opposite one may first strike them. When, however, it is noticed, from three to five of the spinous processes may be seen to form a gradual and slight curve to one side, more especially when the patient is standing or sitting upright; this curve almost always begins in the middle of the vertebral column from the cause explained and illustrated at p. 25. In the incipient stage, when the curve embraces from five to seven vertebræ, it bears a resemblance to the Italic letter *f*, and in this state it can be frequently reduced to the spinal line by recumbent posture and extension.^b At this period, symptoms of nervous irritation and derangement, or of diminished nervous

^a { Mr. Ward states that, of 240 cases of lateral curvature, 230 were to the right side. I have rarely seen left lateral curvature; so that we must suppose Mr. Bampfield's experience to have been, on this head, singular.—ED.]

^b [This } is the usual form, to the right above, and to the left below.—ED.]

energy, are far from being common accompaniments, nor indeed do they constantly occur at any stage of the progress of the distortion; I have, however, seen them early induced with much severity, producing irregular convulsive actions of the muscles of the upper and lower extremities; of the muscles of the eyes; and, in some rare instances, general convulsions have supervened, especially towards night. Muscular debility and a bad state of health have generally ensued from, or accompanied symptoms of nervous disorder.

When the predisposition to lateral curvature is once established, and has produced its elementary effects, those effects lay the basis, or become additional causes of future increase, whose power is independent of the pristine sources or remote causes of malady, and is augmented in the ratio of its progress by the mechanical principle mentioned at p. 56. As soon as the lateral curvature is formed in the dorsal portion of the spine, the ordinary centre of gravity of the body is lost, and, in order to maintain its equilibrium, the patient inclines the cervical and lumbar portions of the spine in the reverse direction, and in the course of time, if it be supposed the curve of the dorsal portion be on the left side, the cervical and lumbar portions will form curves, having their convexity to the right, and thus, as the process of distortion advances, the whole spine will be thrown into unnatural shapes and attitudes of deformity, by which it deviates entirely from the spinal line, and is gradually changed from the form of the Italic *f* (s), to a shape more like the Greek ζ , (sigma), with three curves in the last stage, when there is complete formation of ambilateral curvature. This advanced stage of lost symmetry has been more commonly compared to the figure of the Roman S, but it bears no resemblance to it, nor would it be possible to make the spine assume such a shape by any mechanical force; for if bent into that form, the head would necessarily be inclined over, and hanging down on the side of the body.

As the distortion of the spine has advanced in the directions above-mentioned, the scapula and clavicle on one side, have the appearance of being depressed lower than the other, and of being smaller in size, and they are in fact distant one or two inches more from the head than those on the other side, whilst the opposite shoulder is more prominent, and appears elevated.

One scapula often appears larger, and forms a protuberance called "hump-back," and it, with the clavicle, retains its natural distance from the head, but is farther removed from the spine.^a The ribs on one side project backwards from half an inch to two inches and a half, or three, in the worst cases of deformity, and arrive at the sternum in a conical, instead of a circular form;

^a [In this country the right scapula of girls is very often found unduly protuberant backwards; and from a slight dextro-lateral curve, the right shoulder is commonly too high. These phenomena are present almost at the outset of the disorder. — ED.]

whilst those on the other side advance forwards, and sometimes form a projection of their cartilaginous or sternal extremities as they approach the breast-bone, so that one side of the thorax, posteriorly, appears more capacious than the other, and the other appears more capacious anteriorly, whilst the ribs and breast become flattened on the sides, and give a conical form to the chest. The false ribs on the one side approach the brim of the pelvis, and either leave a small space between them, or are in actual contact; in either case, the lower extremity on that side has *the appearance* of being elevated; whilst the false ribs on the opposite side preserve their proper distance from the pelvis. In all these cases, the head is a little inclined to the concave side of the cervical curve, generally formed by the cervical vertebræ, on which side, the neck and upper part of the breast sunk in and flattened, whilst on the convex side of the same curve, the neck appears round and fuller, as if swollen from some morbid growth.

Lateral curvatures are formed by slow degrees; but here, as in excurvation, if the patient be assailed by an acute disease, such as fever, or any of the exanthemata, which induces great debility, the progress of the disorder proceeds very rapidly, until the strength is regained.

The sternum is sometimes thrown a little to one side, and its natural shape altered, by the heads of the ribs as it were advancing into its substance further than their usual point of articulation. These are the external characters or appearances of the distorted bones, and the parts covering them; their internal state must next be described.

If an original disproportion of growth of the bones of the vertebræ do not primarily give rise to any lateral curvature, an artificial disproportion of the thickness of the sides of the vertebræ ensues as soon as any degree of curve is formed, and increases with its increase. The bodies of the vertebræ and the intervertebral substance are gradually reduced to a cuneiform shape in different degrees, and are consequently diminished in thickness on the concave side or inner line of the curves, and are, for the most part, preserved of their natural dimensions on the convex side or outer line of the curves, and the dimensions of the vertebræ, and intervertebral substance in the centre of those curves exhibit the greatest disproportion. The middle or dorsal curve includes about eight of the upper dorsal vertebræ, and sometimes the whole; the upper or cervical curve is generally formed by the cervical vertebræ alone; the lumbar or lower curve as frequently implicates three, four, or the whole of the lumbar, and about four of the lower dorsal vertebræ.

In some cases, the two lower lumbar, and some of the cervical vertebræ maintain their spinal line. In the advanced stages of lateral curvature, the distortion is not confined to a mere inclination of the vertebræ to the sides as the name implies, for the dorsal portions of the curved spine take a tortuous or serpentine direction, by

which its spinous processes, instead of projecting directly backwards as usual, are twisted to one side, and are directed more to the concavity of the curve, than the convexity.* The effects of this spiral turn of the dorsal vertebræ are remarkable, and greatly contribute to increase the deformity; for, by it, the transverse processes and vertebral ends of the ribs are turned obliquely backwards on the convex side of the curve, and are advanced obliquely forwards on the other side; the ribs, on the side they are turned backwards, form a hump, projecting from half an inch to two inches and a half posteriorly to the spinous processes of the dorsal vertebræ, and in the untoward turn and longer curve they are obliged to take to arrive at the sternum, they sometimes closely approximate or actually touch the lateral portions of the bodies of the vertebræ.

This position of the ribs does not always proceed from the tortuous direction of the vertebræ,† but is occasioned also by malformation or an unnatural irregularity of their growth, which directs them backwards; for, in the case of Miss Bennett, of Tavistock-street, the angles of the ribs on the right side grew backwards, so as to cover the spinous processes, and to be mistaken for them, on examination, during her life; a circumstance which clearly proves that the tortuosity or contortion of the spine, was not a competent cause to direct or turn their angles directly posterior to the spinous processes, or to curve the portion of the ribs backwards between their insertion and angle. As the thickness of the vertebræ is diminished on the concave side of the lateral curvature, the ribs inserted on that side necessarily approach each other closer than nature ordained, and are sometimes in actual contact towards their vertebral ends, whilst on the opposite side, the ribs are rather more distantly separated than usual. The growth of the ribs is also stunted and diminished in a few cases, in the advanced or matured stages of disease, on the concave side of the curve, whilst those on the convex side of the curve acquire their natural dimensions, so that a considerable disproportion of length and of size exists between them, differing, for instance, in length from one to four inches.

In the early stages of lateral curvature, I have not been able, in the generality of cases, to discover any difference of length or of size of the ribs, by very accurate admeasurement, whatever diversity of aspect their altered arrangement gave them, so that it is inferred this disproportion obtains very gradually during the growth of the body, in a few cases, where all means of prevention or cure have been neglected, and the disease has been left to its own course, except where the disproportion has arisen from an original error of growth. As the scapulæ lie on the ribs, and the

* Dr. Dods has recently devoted a volume to this variety of lateral curvature under the name of rotated or contorted spine.

† The ribs sometimes project posterior to the angle of inclination of the vertebral column.

clavicles are articulated to the scapulæ by their scapular extremities, these bones and the shoulder must follow the direction of the ribs, and be carried back on the side the ribs project backwards, and be turned forwards on the other side. The scapulæ thus unnaturally situated, bear so little resemblance to each other in size, as to give rise to ocular deception and incorrect opinion, for the one drawn back sometimes looks as large again as the other, and creates an opinion of their disproportionate growth and size, the error of which is only removed by dissection, which displays them of equal size. This is explained by the rules of perspective in drawing, for the part in the shade looks the smallest, and in the foreground the largest. The ligaments are not relaxed, or their structure often morbidly altered in lateral curvature; they, however, contract themselves on the concave side of the curve, so as to be adapted to the diminished dimensions of the vertebræ on that side.

Instances of carious vertebræ in this variety of curvature are very rare, and where they have occurred, the caries has been occasioned by scrofulous action, which has extended to the intervertebral cartilages and ligaments, and excited an ulcerative action in them, from the joint effects of which the vertebral joints have been destroyed, and the necessity of a cure by ankylosis induced, as in excurvation. In the generality of cases, however, the integrity of the joints is preserved, and their articulations are so distinctly maintained, as to allow of considerable motion in all directions, with the body bent to one side, or curved in different directions to both. The bodies of the vertebræ may become very thin, and shaped like a sharp wedge on the concave side, whilst they retain their proper breadth, on the other; but, however great the curvatures, the bodies of the vertebræ and intervertebral substance are not entirely destroyed, as occurs both from ulcerative and progressive absorption in excurvation. This probably depends upon some law peculiar to rickets.

Lateral curvatures of the cervical vertebra only occasionally occur; in Mr. Brooke's Museum, there is a rare specimen of an irregular growth of bone producing lateral curvature of the upper cervical vertebræ in an adult,* without evincing any appearance of caries or of rickets. The first, second, and third cervical vertebræ are united to each other and to the occipital bone, by ankylosis; and a bony septum of considerable size is thrown across the commencement of the spinal canal. The line of curvature on the right side measures one inch three lines, and on the left side, two inches four lines; so that there is a difference of one inch and one line between the convex and concave lines of curve, and consequently of the thickness of the vertebræ.

This cure by ankylosis is one exception to the general rule. Specimens in the London museums, however, exhibit ankylosis of the transverse and articulatory processes, as well as of the ribs,

* *i. e.* The skeleton is that of an adult.

induced in lateral curvature, yet in such instances even, there is scarcely a mark of ankylosis of the bodies of the vertebræ. The distorted disposition and altered proportions of the vertebræ and ribs, necessarily produce changes in the muscles attached to them. From the approximation or contact of the ribs on the concave side of the curve, the intercostal muscles are shortened and almost obliterated in some instances, which is the case of the intertransversalis muscles. These muscles are necessarily obliterated, where ankylosis of the costæ and transverse processes has been formed. From the approximation of the edges of the false ribs, to the brim of the pelvis on the side of the body, corresponding with the concave side of the dorsal curve, the abdominal muscles on that side are contracted or shortened in dimensions, whilst the descent of the scapula and clavicle on this side, occasions an elongation of the muscles connected by their attachments to, and situated between the head and cervical vertebræ, and the clavicle, scapula and ribs. The condition of the dorsal muscles is much altered, as, on the convex sides of the curvatures, they are stretched, and in some degree lengthened and are larger, and on the concave side, they are shortened or contracted, and are smaller, and in the proportion of their permanently contracted or shortened state, is the original contractile power, exerted by those muscles, diminished; whilst, on the opposite or convex side, the contractile power remains in full force, yet the rigidity of the muscles in a state of permanent contraction and shortness on the concavity of the curvature, offers great resistance to the reduction of the vertebral column to its spinal line, although the muscles situated on the concave side possesses less density, and appear somewhat wasted.

Some of the spinal muscles present particular and unnatural appearances; — for instance, on the convex side of the dorsal curve, particularly if the vertebral ends of the ribs project or grow backwards, the longissimus dorsi and sacro-lumbalis appear so full and prominent as to protrude backwards like a tumour,* and, from the displacement of the scapula, it sometimes happens that the edge of the latissimus dorsi does not pass over the lower angle of the scapula, but lies below it. From the altered position of the scapulæ, some of the muscles inserted into them must be lengthened and others shortened, and the action of others must be deranged by the altered direction their fibres are thrown into. In lateral curvature, as in excurvation, the lost power of the shortened muscles has been mistaken and described by authors, as a state of paralysis. — See p. 21, *et seq.*

From the shortening of the ribs, and from their being situated in closer contact, or actually ankylosed on the concave side of the curvature, the capacity of the thorax on that side is diminished, and the lung it encloses is necessarily prevented from developing itself,

* Mr. Shaw observes, that he has known this appearance mistaken for large tumour. — *On Distortions*, p. 113.

and arriving at its natural size, whilst the lung on the convex side of the curvature is frequently much compressed by the too close and unusual approximation of the ribs to the bodies of the vertebræ on that side already described; hence, from the state of the ribs and the shortened or obliterated condition of the intercostal muscles, it is, that a free expansion of the lungs in inspiration cannot be effected, and the patient suffers from difficult respiration and disordered pulmonary circulation. Palpitation of the heart sometimes accompanies the dyspnœa.

When the concavity of the curve is on the left side of the body, the length of the vertebral column on that side is reduced by the curvature, as well as by the diminished thickness of the bodies of the vertebræ, and hence, the aorta descendens, the thoracic duct and trunk of the intercostal nerve, must be either shortened in a corresponding ratio, or take a serpentine course, either of which will tend to deprive the organs and parts which derive their blood and nerves from them of part of their nervous energy, and their supplies of blood for nutrition. If the lateral curvature have taken place during the growth of the body, as usually happens, the growth of the lungs and different viscera, as well as of the large blood-vessels, may be considerably modelled by, and accommodated to, the altered conformation and disordered arrangement of the bony structure; the patient, however, seldom escapes without being subject to dyspnœa, where the disorder has been left to its uninterrupted course.

The spinal canal is preserved continuous, but it necessarily follows the serpentine course of the vertebral column, and is deprived of its perpendicular direction; its calibre is frequently contracted about the centre of the curves, and is sometimes diminished to one-half of its natural size; the portions of bone which immediately form the channel are very seldom diseased; cases, however, are recorded in which the bones, in lateral curvature, have been found on dissection more vascular and softer than natural, with a morbid deposit in the cancelli, and even carious, all of which were the result of scrofulous action. — *Lloyd on Scrofula*, p. 215.

In lateral curvature, diseased action is not frequently implanted in the medulla spinalis or its membranes; irritation is, however, sometimes propagated to them from the bones in the state of disease just described, and produces inflammation terminating in effusions and collections of lymph and pus in the spinal canal, and in depositions of coagulated lymph on the theca vertebralis, sometimes attended with paraplegia. — *Lloyd*, pp. 236-7.

The medulla spinalis is necessarily diminished in its volume in that part of it which occupies those portions of the spinal canal lessened in its calibre. Its fibres are not of one uniform length, as they must be longer on the convex side of the curve than on the concave. The nerve proceeding from the medulla spinalis are sometimes smaller, even by one half on the concave side of the curves than on the convex, and hence it may be fairly inferred,

that the organs, bones and muscles, deriving their nervous influence and energy from such diminutive nerves must be deficient in both, and the actions which depend upon them must be defective. The nerves must take unnatural courses, and be shorter or longer than natural, as they happen to proceed from the concave or convex side of the curves.

In the generality of cases of lateral curvature, there is not any pain complained of in the course of the curves, nor is any felt or excited by pressure; nor is the power of the muscles so much weakened in general, as in excurvation. Yet, when scrofulous irritation and inflammation, with the results described in the last paragraph, are experienced by the bones and medulla spinalis, pain is felt in the course of the curvature; spasms of the extremities and diaphragm take place; the muscles of the extremities become disobedient to the will, and the patient cannot walk steady, or the muscles may become paralytic;* obstinate constipation ensues; incontinence of urine and fæces casually happens; dyspnœa with a sense of suffocation occurs; the irritation of the medulla spinalis is communicated to the nerves united to and proceeding from it, and various nervous symptoms and feelings are induced; in young females, hysteria sometimes takes place, and the menstruation is painful or suppressed; — this latter event is, however, more common in excurvations, as should have been observed. It may be stated, that Mr. Lloyd relates a case of lateral curvature attended with lumbar abscess.— Pp. 258, on *Scrofula*. This is an uncommon occurrence,

The various distortions of the spine and ribs, necessarily produce as many various changes from the natural forms and positions of the viscera which are enclosed within the thorax. For instance, when the sternal extremities of the ribs advance forwards in a conical shape, they sometimes protrude forwards and compress the heart, and produce palpitation. When the vertebral ends and angles of the ribs on one side project backwards, and, in the turn they make to arrive at the sternum, they approximate very close or touch the bodies of the vertebræ, they must necessarily compress the lung on that side, or have prevented its natural development. In this state of the ribs, one kidney may be compressed, and, if it be on the right side, the liver may be pressed upon. The situation of the abdominal viscera must be altered by the approximation on one side of the costæ to the spine of the ilium, and by the tortuous state of the spine. Still the alterations are so various as to baffle all particular description.

The general health is not much impaired in numerous cases of lateral curvature, during formation, except they are combined with scrofula; permanent lateral curvature, however, stunts the

* It has been observed by many authors, that the condition of the muscles in the paralysis from diseased spine, differs from that in ordinary palsy, and that the muscles are not so soft, but the joints are more rigid.

growth of the body, and prevents it from being fully developed, probably from the altered course of the spinal cord, and the diminution of the nerves proceeding from it, as well as from the disturbed circulation produced by the deranged state of the thoracic and abdominal blood-vessels. The respiration is also affected by the mechanical pressure and distortion of the ribs. The lower limbs are often smaller than natural, and an inequality of length is sometimes permanently established between them.

In the progress of lateral curvatures, some degree of excurvation occasionally arises, which is more generally perceptible in the advanced stages.

SECT. II. — *Remote Causes of Lateral Curvature.*

The remote causes of lateral curvature are rachitis, or disproportion of growth of the sides of the vertebræ; unequal length of the lower extremities; undue pressure on one side of the vertebral column from carrying heavy weights on one arm, by which the spine is bent to one side; an inclined position of the body to one side long continued; muscular debility; rheumatism of the intercostal and dorsal muscles; abscess on the side of the neck or trunk; scrofula; tumours. Is unequal action of the dorsal muscles a cause?

The manner in which rachitis predisposes to, and produces curvatures, has been explained at p. 44, and as my experience in lateral curvatures is extensive, I may be allowed to infer that rachitis is the fertile source of them in two ways:—First, by creating an irregular growth of the bodies of the vertebræ, which destroys their relative and natural proportions; and, secondly, by occasioning a disproportionate growth of the lower extremities, which varies or destroys the natural centre of gravity of the body;—and in most instances of spinal distortion from this cause, unequivocal appearances of rickety growth and deformity have displayed themselves in the bones of the upper or lower extremities. Lateral curvatures have, indeed, been generally attributed to a rickety growth of the vertebræ.

It has been assumed by some recent authors, that an inequality in the bulk of the arms, and of one side of the body, combined with the more constant use of one arm, will produce lateral curvature, by drawing the body down on one side, which causes other portions of the column to be bent in the opposite direction to preserve its equilibrium.* I have seen instances of incipient lateral curvature produced in young females, who were employed during their growth, in carrying and nursing children, when their strength was inadequate to the burthen, and the weight of the child compelled them to bend; and as the child has been generally borne on

* Mr. Ward on Distortions, pp. 26-27.

the left arm, the cavity of the first or dorsal curve has been commonly on the left side; and if any person, during the growth of the body, were in the constant habit of carrying such a weight in either hand for a long period every day, it may be presumed that such a practice would be equal to the production of lateral curvature, by the lateral bends and curved attitudes it would compel the spinal column to assume; and if such a case of unnatural growth of one side were to occur, as should occasion an enormous inequality of bulk and weight in the upper extremities, it might possibly occasion this curvature, but as yet, I have not witnessed such a case, nor found such a one on record. I have seen a tumour weighing sixteen pounds, situated on the right arm, without producing lateral curvature by its weight, and I have not found reason to infer, that the ordinary inequality in the development of the upper extremities from the more active employment of the right or left arm in preference, has been the cause of lateral curvature;—indeed, were this effect of increased size and activity to be admitted, it would follow, that all, who lose one arm by amputation at the shoulder joint, or high up on the humerus, would be doomed to this curvature, as in this case, there would not only be inequality of bulk and weight on one side, to which there is no counterpoise, but the muscular action would be entirely confined to the remaining upper extremity of one side of the body. Mr. Ward thus endeavours to illustrate his assumption. “Let it be supposed,” says he, “that an individual, standing with both feet close to each other, took a weight in the right hand with the arm extended, and that he continued the position, in which he necessarily threw himself to preserve his equilibrium, *for a considerable length of time*, it would be found that the left shoulder inclined greatly to the left side; that portion of the spine on a line with the left shoulder would be slightly drawn towards it; that a second curve would ensue with its convexity towards the right side, and again, a curve would take place in the lumbar region with the convexity towards the left ilium, &c.” As the premises of this illustration appear to me to be unsound and inapplicable, the conclusions from them become invalidated. For no person can keep the arm extended “for a considerable length of time, with a weight in his hand,” who has not been trained to such a practice, for I have seen the experiment tried for a wager over and over again, and have not witnessed any one, who could keep the arm so extended five minutes, and few can hold it extended that period of time without having any weight in the hand; in this experiment, the vertebral column does not begin to bend until the arm be weary, and the person still perseveres in attempting to maintain it in a horizontal line, for if he allow the arm to be gradually carried down to the side by the weight, the spine does not necessarily bend; but if he perseveres in endeavouring to keep the arm extended horizontally after it is weary, the spine will assume all the curvatures Mr. Ward has described. Besides, I am not aware of

any occupation in life, that requires weights to be carried by the arm horizontally extended, if we except the custom of some fanatic devotees in the East; nor is it a faulty habit, likely to be acquired, and to give rise to lateral curvature.

I have seen instances of lateral curvature produced by a habit of long continued inclination of the body to one side, after the adult age, in insane persons; in the young and growing, this is a more common event. Young artists of both sexes are liable to lateral curvature from this cause, from adopting a habit of sitting before their paintings and drawings with an inclination of the body to the left side, with the left arm resting on the elbow or hanging by the side, sometimes with the palette in the left hand, whilst the right arm and shoulder are raised, for the purpose of directing the pencil, and the head is directed to the left shoulder, and in this position the spine is kept in a state of lateral curvature, for a long continuance of time.

Some eminent artists in London are distorted from this cause. Young ladies and boys who sleep two in a bed are apt to lie always on the same side of the body and bed, and become liable to lateral curvature from this cause, as are all young persons who sleep constantly on one side, with the side of the head and shoulder resting on pillows, as in that position the spinal column is bent into a lateral curve. Young persons who always sit on the same side of a fire or window, are also liable, by acquiring a habit of leaning to one side.

Rheumatism of the intercostal and dorsal muscles on one side of the body, produces the same effects as long-continued position, which it occasions, as well as debility of the spinal muscles from the inaction attending it. An abscess or ulceration of one side of the neck or of the chest, particularly of a constitutional character and of long duration, will conduce to the formation of lateral curvature, by inducing a long-continued inclination to that side, in order to avoid the motions, as in rheumatism, which bring pain in their train; besides which, experiment has proved, that a free discharge of pus, maintained for a long period on any particular part of the body, tends to diminish the growth of that part, and hence, one cause why the ribs and muscles on the side the abscess is situated, are not fully developed, and are, in some such cases, of smaller dimensions than on the opposite side. If the scrofulous abscess be of long duration and situated on the side of the neck, lateral curvature of the cervical vertebræ is produced; if on the side of the chest, lateral curvature of the dorsal vertebræ ensues. Scrofula occasions lateral curvature, by the same action differently directed, by which it produces excurvation; in the former, its action is established on the side of the bodies of the vertebræ; in the latter, it is implanted in the anterior portion of them, as has been explained.

Of all the causes (supposed or real) of lateral curvature, there is not one, the belief of which has obtained so generally and popularly among the profession, as the unequal action of the dorsal

muscles ; and yet, I have not met with one, whose explanation of the *modus operandi* of this cause, carried conviction, or whose proofs could be considered conclusive. To produce unequal action of similar muscles, there must previously exist unequal power, or one set of muscles must act spasmodically. I have never seen spasms of the dorsal muscles become permanent or followed by permanent lateral curvature. How are we to ascertain that an unequal power exists ? This cannot be demonstrated.

It is, therefore, assumed, by the abettors of this doctrine, that it is so ; and they infer, that the set of dorsal muscles which are deficient in power, are overcome, and suffer the spine to bend to the side on which the stronger set of muscles are situated, and this side is said to be the concave ; now it so happens, that in cases where proofs of diminished power of the dorsal muscles on one side exist, the very reverse happens ; for instance, if a person receive a contusion or wound of the dorsal muscles, which necessarily weakens them, he invariably inclines to that side, and is not drawn to the opposite side, where the power of the dorsal muscles remains entire. Besides, it is a fact that dissection has disclosed, and which an accurate observation of the living will evince, that the muscles on the concave side of a lateral curvature, whose power is assumed to be the greatest, are both smaller and shorter than those on the convex side, and if the power of muscles be in the ratio of their density and length combined (see pp. 21 & 22) the above inference must be incorrect, and the explanation deemed unsatisfactory. Again, if the inference were true, and the muscles on the concave side of the curve occasioned that curve, by their greater power of contraction, a very singular pathological phenomenon would be presented in the double or triple lateral curvatures ; for instance, the dorsal muscles on one side of the spine, would, by their greater power, produce a curve in the central parts of the spine, and on the other side, by the same cause, a curve above, and a curve below it, in the cervical and lumbar portions, in an opposite direction ; so that we should have both sets of muscles contracting, in different portions of their length, both stronger and weaker at the same time, or one portion of a muscle must be in forcible contraction, whilst the other is relaxed, which is neither consistent with reason nor analogy.

I have observed the condition and action of the dorsal muscles in the earliest stages of lateral curvature, attended with muscular debility ; and the following were the phenomena they represented. After the patient has kept the spine erect, until the muscles are fatigued, the spinal column suddenly sinks down, and bends to one side, and the patient inclines to the other, to maintain the balance. In this state, they remain quiescent.

Some fashionable follies of modern education are justly accused of producing this species of curvature, especially in young females, first, by establishing habits that deprive the muscles of the back of their natural exercise and actions, and thus prevent the attainment

of their natural strength, or, by their inaction, induce debility; and, secondly, whilst in this state of debility, by endeavouring to subject the spinal muscles to more exertion than they are capable of using, in the injunctions they receive, to keep the body constantly erect, in the standing and sitting attitudes. Thus the spinal muscles of young females are doomed to inaction, by the trunks of their bodies being imprisoned in stiff stays, or their movements abridged and confined by the use of collars, braces, backboards, or by being stretched motionless on reclining boards, or school-room floors; — or they are subjected to long continued exertion, and the use of one posture, which all our muscles abhor, and soon become weary of, by being placed in education chairs or stools, the long forms of school-rooms, or on the round stool, to practise for hours on the piano-forte or harp, with strict injunctions to keep the body quite upright, and menaces of punishment, if they stoop or bend in the least; but the muscles must sometimes obey divine, instead of human laws, and when fatigued and weary in the erect posture, must gradually follow the Creator's law, and seek repose, by allowing the body to sink into an inclination to one side or the other, and, by laying the basis of lateral curvature, produce the reverse of what human wisdom intended. Thus, from too much anxiety about the elegant and proper development of the female figure, tyrant fashion, under the apparent sanction of custom, and the specious guise of education, has usurped the prerogatives of nature, has abolished the freedom of muscular action, and has presumptuously substituted the rules of art to direct the growth, and mould the form of the human figure, and direct its muscular powers! — Surely the Creator never intended these restraints; nature disdains them; and *he* who gave us powers to maintain the spine erect, also ordained its form to be bent, and its movements to be unfettered. Before man became subject to the influence of refined civilization, he enjoyed the privilege of free exercise of all his muscles, in the most untutored and unlimited manner, practised what attitudes he pleased, indulged in such sports and pastimes as he listed, and, when weary, assumed the recumbent posture he chose, without being shackled by the dictates of art; spinal deformity was then unknown to those who lived in a free state of nature, often called savage or barbarous. The growth of the body, the proportions of form, the adjustment of the figure, the turn and directions of the bones, were left to the unerring hand of nature, and freedom of muscular movements. But, by the force of cruel fashion, nature is almost forsaken, and art is so preposterous and assuming as to offer dictates, and prescribe directions to form the body agreeably to its natural configuration; and parents, and proprietors of female seminaries or schools, are so silly and unreasonable as to submit to their guidance. Nay, this submission to the suggestions and dictates of art has even been made in one department of our government, and in a great national institution for the rearing of orphan children of

soldiers, there is established the appointment of an exercise and figure master, with the pay of a captain in the army, who is to control and give a proper direction to the growth of the body, "to teach the young idea how *to shoot*," and elicit and confer tone on all their powers, by artificial exercises of particular muscles, in a numerous train of movements, and list of attitudes.* Against these artificial habits and customs, wisdom has launched its mandates, genius has levelled its enlightening arguments, experience has pronounced its judgment, reason has fulminated its reproaches, wit has pointed its keen shafts of ridicule, and authority has proclaimed its interdictions; yet the folly of fashion increases, and its prevalence extends! In passing through the school-rooms of the seminaries for young ladies, what can be more appalling and preposterous, than to see the motionless figures of a long row of young ladies lying on inclined or horizontal planes of deal boards, "like *patients* on a monument smiling at the white-washed ceilings," or like the mute statues on tomb-stones of those interred beneath, and from which we should hardly distinguish them, were it not for the occasional movements of the muscles of their (should be) brilliant eyes, or laughter-loving muscles of the face, whose situation defies control and eludes confinement. The conduct of boys' modern schools, is, also, exposed to serious objections, in common with the girls' schools. Boys and girls are too much shut up in small playgrounds, like prison yards, instead of being allowed to range the valley free, or girls have small gardens to walk in enclosed by high walls, like those of the asylums for the insane. What can be more contrary to nature's freedom of movement, than marching schools of boys and girls, in rank and file, like the boys at the military asylum, instead of allowing them to move at ease, in any place they prefer, or are prompted to?

Without digressing further, I would observe, instead of stiff stays, back boards, reclining boards, education chairs without backs, military marching, &c., let the girls and boys have no clothes or apparatus to limit their movements, and when weary, let them sit down on chairs with proper curved backs to support the spine, or lie down for rest, or, in fact, seek repose as they find most agreeable, when they are fatigued, or can no longer maintain an erect attitude conveniently.^a Let the girls have a large field or play-ground, let the boys, also, have the range of the country, within the sound of the school-bell. Let the girls engage in the games of battledoor and shuttlecock, skipping, dancing, and all that they can play at. Let the boys play at cricket, trap and ball, shinney, fives, skipping, running, coits, marbles, climbing trees, jumping, &c.,* and we shall not have many

^a [Although I agree with the author in condemning the restraint

* This practice is said to be introducing into our great schools.

distortions of the spine; and, without intending to give offence, I will venture to express an opinion, that if the amount of a captain's pay was laid out for the use of the boys at the military asylum, in the purchase of cricket bats, trap and balls, skipping ropes, swings, shinney sticks, marbles, coits, &c., there would not be any occasion for exercise masters, or surgeons to cure deformities, unless arising from scrofula or accident.

Under circumstances of unequal growth of the extremities, the dorsal muscles are directed by the will to bend the spine to one side, or in different directions, to preserve the centre of gravity. The habit of standing on one leg has an effect nearly similar.

The cervical vertebræ are subject to direct lateral curvatures, from the pressure of tumours on the sides of the neck, from long-continued contractions of its muscles, in the complaint called wry-neck, and from untoward positions of the neck, arising from bad habits, or large heads.

In lateral curvature, the predisposition in the absorbents to take up bone and cartilage, and reduce the dimensions on the side pressure is applied, is more evident than in any other variety; because in this, the bodies of the vertebræ are very rarely destroyed altogether by ulcerative or progressive absorption, as happens in ex-curved, and by which result, the further effects of pressure are taken off; but although the horizontal surfaces of the vertebral joints remain in contact, and the patient uses no means to lighten or take off the superincumbent pressure, yet the further absorption ceases at an undefined time, when the effects of pressure are still exerting their full force, by the increased extent of the curve, and leaves the spine in the curved state, that permanently subjects it to unequal pressure, without any future or further disproportion of the vertebræ ensuing.

In the generality of such cases, it is probable, that the softer texture of the bone prevailing in rachitis, disposes the absorbents to act upon it, and occasions them to be excited by pressure, and

of stays or corsets when girls are healthy, I believe that such supports are necessary when girls are weak and incapable of keeping themselves steadily erect. In such cases, properly-made corsets give immediate relief to muscles *pained* by undue effort, and restore the frame to its proper erectness. By such simple means of support, I have often corrected, perfectly and permanently, the inequalities of shape, which were quite obvious; and have in a few days relieved the pain of shortened muscles, which had been inconveniently felt for several months. Girls were thus enabled to take beneficial exercise, who could not previously bear it for an useful length of time. It is a curious fact, which I pointed out many years ago to Dr. Physick, that the cases of lateral curvature which commence before corsets are used, are to those which happen afterwards, as thirteen to one. Corsets, therefore, although they produce many evils, do not create spinal curvatures.—ED.]

that when the rickety diathesis is corrected, the earthy deposits consolidate and harden the bone, by which it is enabled to sustain the pressure, without producing any unusual excitement or local action of the absorbent system. In the advanced stages, when the curvatures are double and triple, the variety of inflections will tend to diminish particular pressure, and divide it more generally among the vertebræ, so as to conduce to their preservation, from utter destruction or absorption.^a

SECT. III. — *Immediate Causes of Permanent Lateral Curvature.*

The immediate causes of lateral curvature are the same as of permanent spinal distortion in general, p. 49, and will be found in the morbid alteration of structure of the sides of the spinal column, producing such a disproportion between them, as renders it impossible to restore it at once to the perpendicular figure, and retain it in its true spinal line. This alteration of structure is rarely effected by scrofulous caries, or ulcerative absorption, on one side of the bodies of the vertebræ, and when it is produced, the curvature is generally single, and the scrofulous caries only affects one or two vertebræ.

When scrofulous inflammation and ulceration attack the horizontal surfaces of the bodies of the vertebræ, or intervertebral cartilage, there does not appear any exclusive reason, why they should not particularly affect one side only of the horizontal surfaces of the vertebræ, and produce a lateral curve; but still the fact is otherwise, for it generally attacks the whole horizontal surfaces, and produces excurvation, to which some degree of lateral curvature is sometimes superadded, by one side of the bones being subsequently absorbed, rather more than the other parts of the horizontal surfaces.

The ordinary lateral curvature, to which that just mentioned is a rare exception, effects many vertebræ, and is produced by progressive absorption, or by an undue growth of bone combined with it. I shall now endeavour to establish the connexion between cause and effect, and prove the adequateness of one to produce the other, but shall first remind the reader that topical pressure is the most powerful agent for producing local absorption.

It cannot be doubted that the rickety condition of bones disposes them to inequality of growth, deviating from the natural pro-

^a [Repelled eruptions, as the desiccation of humid tetter, &c., are, according to Guérin, Physick, Abbie and Parsons, causes of lateral curvature; and Dr. J. Randolph has observed, that some of these cases are associated with chronic inflammation of the edges of the eyelids.—Ed.]

portions, as examples of this deviation and inequality must be familiar to every practical surgeon. The inequality of size, and unnatural growth, occasionally extend to the vertebræ, and produce lateral curvature. At p. 53, it is stated, that an increased growth of bone on one side of the spinal column, must necessarily elevate the parts above it on the same side, and by inclining them to the opposite side, there occasion undue pressure on the intervertebral substance, or bone softer than natural, and predisposed to absorption, by which its progressive absorption is induced. Thus, increased growth on one side of the bodies of the vertebræ, and progressive absorption from pressure on the other, conspire in destroying the natural proportions of the vertebræ, and of deflecting them from the spinal line to the form of a curve. To prove further that an inequality of the sides of the vertebral structure must dispose them to the form of a curve, and no other figure:—if bones of unequal thickness, and cuneiform shape, be successively disposed over each other, they must eventually be inclined to one side; and, if there supported, will be formed into an arc, such as is observed to result from the disposition made of cuneiform stones in constructing the arch of a bridge.

If a mixture of elastic and inelastic materials, of the same shape, be similarly disposed, with joints and mechanical contrivances, like those of the spinal column, to retain them in their situation, they will necessarily form an arc, and if a weight be then appended to the extreme of the curve, it will increase the curve, as well as the pressure on its concave side; so, when a lateral curvature is formed by the unequal thickness of the sides of the vertebræ, the superincumbent weight of the head, and the appended weight of the shoulder, on one side, will tend to increase the curve, by their pressure exciting absorption. One lateral curve being established, gives rise to a second or third, from causes that will be presently explained.

It has occurred in my practice, that more cases of lateral curvature have originated in a disproportionate growth and length of the lower extremities, than from any other single cause; and although this circumstance has too much escaped the observation of surgeons, it is, nevertheless, the fact. The disproportion of length varies from half an inch to two inches and a half, and arises either from an extraordinary development and growth of one extremity, which is frequently larger, as well as longer, and preserves its natural form; or from the diminutive growth of the other extremity, or from the ankle or knee joints bending, so as to cause one to be shorter than the other; the former is the more common cause, as the latter frequently exists without producing curvature. When the disproportion of length is established between the two lower extremities, one of two consequences must follow, to enable the patient to preserve the centre of gravity of the body; either the longer extremity must bend, so as to be reduced to the same longitudinal measurement as the other, by part of its length being turned off into a curve or angle, and so diminished, or the verte-

bral column must be inclined to one side, to maintain its equilibrium. In the former case, the person becomes knock-kneed, from the bones of the knee-joint turning inwards; — or they may incline outwards, from the femur and tibia, forming an angle at the joint, by which the perpendicular length of the extremity is diminished, or the shafts of these bones may bend, and the difference of length be obviated by a bow-leg, or curved femur, and the spine remain straight. In the latter case, the longer extremity retains its perpendicularity, without bending, which it does very often, for a long time. Let it be supposed that the right is the longer extremity, and it follows that the right side of the body must be lifted up in the erect attitude, and thrown over on the left side, so that, to maintain such an equilibrium as would enable the patient to keep the erect position, he must incline the head and neck to the right side, in which attitude, the dorsal vertebræ would form a curve with the convexity to the left side, and the cervical vertebræ would form a slight curve with its convexity to the right side, and this alteration of attitude seems to be the result of natural necessity, in order to maintain the balance of the body, or preserve its centre of gravity. When the vertebral column is thus curved, there must be unequal pressure on different portions of the vertebræ, that on the concave side of the curves being increased, whilst that on the convex side is diminished, and as the original cause continues, the vertebral column will be forced from its spinal line, by the exertions to preserve the equilibrium of the body, and by the unequal distribution of superincumbent weight over the surfaces of the vertebræ, so that the bodies of the vertebræ and intervertebral substance on the concave sides of the curves will become absorbed from pressure, in the process of time, and rendered thinner, whilst the convex lines of the curves will remain of their natural thickness, or the intervertebral substance will be there rather thicker than natural.

When this disproportionate condition of the vertebral column is produced, the lateral curvature will remain and increase, independently of any malformation of the lower extremities, and the curvature, which at first was a temporary inclination of the body to one side, necessary to maintain its equilibrium, gradually degenerates into a disproportion of breadth between the sides of the bodies of the vertebræ, and intervertebral substance, that constitutes a permanent curvature, called lateral, but is, in fact, ambilateral, if such an expression may be tolerated: for, in the advanced stage of distortion, in which the spine so nearly resembles the Greek ζ (sigma), a superior, middle, and inferior curve are induced on opposite sides, whilst the spine assumes a tortuous and semi-spiral turn already described.^a

^a [I have seen, of many cases, but one dependent on an inequality of the lower limbs as to length. Patients who have scrofulous curvature, may also have disease of the hip-joint. That complication I have seen several times. — ED.]

During the progress of lateral curvature, from its slight to its extreme degree, it frequently happens that the bones, forming the knee-joint of the longer extremity, become bent outwards or inwards, by which its perpendicular length is reduced to that of the other, and the spine might be restored, as far as this obstacle of inequality had opposed it, but the cuneiform shape of the bones now induced, prevents this alteration in the extremities from being useful. — In my experience, it has generally occurred that the right has been the longer extremity, by which the great curve of the dorsal vertebræ has inclined to the left side.

It seems needless to prove, that the bow of the extremities decreases their perpendicular length, as the fact must be familiarly obvious to every one. I have once seen lateral curvature, apparently occasioned by an unusual development of the right side, by which all its dimensions were larger than the left.

Rheumatism; abscess on the side; carrying heavy weights on one arm, as a child, whilst the body is growing; long-continued lateral position, are remote causes, which conduce to lateral curvature, by inclining the body to one side, and thereby occasioning undue pressure on one side of the bodies of the vertebræ, by which the active principle of absorption is excited, and the thickness of the spinal column on that side diminished. It is thus that the first curve is formed from the above causes; those that succeed, ensue from the inflections made from necessity, to preserve the balance of the body, also producing undue pressure and absorption; but, unless there exists a rickety condition of bone, I think, lateral curvatures seldom become double. Tumours on the neck sometimes occasion lateral curvatures of the cervical vertebræ, by inclining them to one side, and subjecting them to undue pressure.

When tumours are, however, situated close to the spine, they sometimes effectually oppose the formation of curvature, by filling up the space occupied by the portions of the bodies of the vertebræ they have destroyed by their pressure, and embracing the intervertebral substance, which, in such cases, often escapes absorption, and thus preventing that part of the spinal column from bending from its spinal line; specimens of which may be seen in different museums.

Patients affected with lateral curvature seldom lose their lives, even when the disease has been left to nature, unless scrofulously affected. It, however, permanently occasions dyspnœa and asthma, and the health of the subjects of this curvature is generally delicate, and easily disordered, but there are many exceptions to this observation, and, aided by a guarded regimen and regular habits, a good share of health may be enjoyed by those doomed to endure for ever this deranged structure.

SECT. IV. — *Dimensions of the Vertebræ and Ribs, some Specimens of Lateral Curvature, &c. &c.*

Many of the general observations and descriptions will be con-

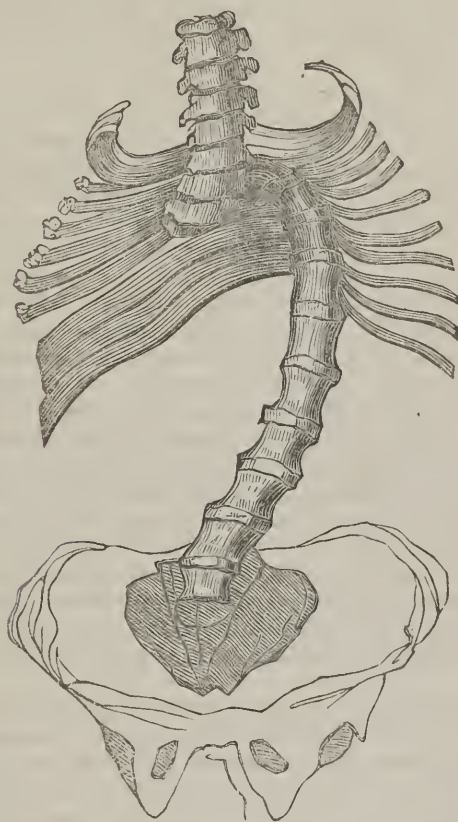
firmed and illustrated by the following measurements of some specimens of this species of disease or distortion.

Specimen 1st.—In this specimen, the cervical vertebræ are slightly curved, with their convexity to the left side; the eight upper dorsal vertebræ form an arc, with the convexity to the right side, the four lower dorsal, and three upper lumbar vertebræ form an arc, with the convexity to the left, and the two lower lumbar vertebræ incline a little to the left. The whole spine is tortuous, and many of the spinous processes have received a lateral direction.—The 3d, 4th, and 5th dorsal vertebræ form the central bones of the dorsal curve. The bodies of these three dorsal vertebræ on the convex side of the curve, each measure eight lines or eight and a half in thickness; on the concave side, only five lines each; the intervertebral substance between these bodies on the convexity of the curve, measures from two to three lines each; and on the concavity, it is reduced to from one half to one line each. The 10th, 11th, and 12th, dorsal vertebræ, are the most disproportionate of those involved in the lumbar curve. On the convex side of the curve each of their bodies measures 11 lines in thickness; on the concavity, the body of the 10th measures seven lines; of the 11th, three lines, of the 12th, five lines. The thickness of the intervertebral substance, between those three bones, and the 12th dorsal and 1st lumbar, on the convexity of the curve is four lines, and on the concavity is only half a line. The ribs are of equal length on both sides, and the pelvis is not deformed.

Specimen 2d.—In this, the cervical vertebræ are slightly inclined to the left; the eight upper dorsal vertebræ form a curve, with the convexity to the right side, the four lower dorsal vertebræ and five lumbar are involved in a curve with the convexity to the left. The 4th, 5th, and 6th dorsal vertebræ, form the central bones of the dorsal curvature; and the breadth of their convex sides, including the intervertebral substances, measures 25 lines, whilst that of the concave side measures 16 lines. The 11th and 12th dorsal and 1st lumbar vertebræ form the central bones of the lower or lumbar curvature, and offer great disproportions between the thickness of the bodies of the vertebræ and intervertebral substance on the concave and convex sides; the admeasurement of the 11th and 12th dorsal and 1st lumbar, with their intervertebral substance, being only 15 lines on the concave line of curve, and 40 lines on the convex side. The dorsal and lumbar lateral curvatures incline backwards, and combine a degree of excurvation with them. The ribs on each side are of equal length, and the pelvis is not deformed.

Specimen 3d—is a singular specimen of irreparable deformity, and unusual disorganization of structure for this species of distortion. The cervical curvature is inclined a little to the left side. All the dorsal and lumbar vertebræ are more or less involved in the dorsal or lumbar curves, which are bent in the shape of the annexed attempted diagram, in which the first four dorsal vertebræ form a convexity to the right side, the lower part of which ap-

pears to rest on the 6th, 7th, and 8th ribs of that side; the 4th, 5th, 6th, and 7th dorsal vertebræ lie horizontally across the spine, very much reduced in size, without any distinct articulation remaining, and they do not add half an inch to its perpendicular height; the four lower dorsal vertebræ form a curvature, with its convexity to the left side, to which all the lumbar vertebræ are inclined.



The five uppermost ribs on the right side of the dorsal curve in advancing forwards touch the sides of the vertebræ, and the 6th and 7th ribs on the left side touch the convexity of the vertebræ on that side. The five superior ribs on the left side cross the inferior portion of the spine, and the four lower ribs on the right side cross the upper portion of the spine, as their vertebral extremities approach their vertebral articulation. The ribs are of equal length on both sides; but on the right side lie in much closer contact, and the intercostal muscles are very short. The breadth

of the eight lower ribs on the right side with the spaces between them is only four inches, four lines, and on the left side is six inches, two lines. The greater space left between any two ribs on the right side, anteriorly, is three lines and a half, and on the left side is seven lines and a half; and on the posterior portions, the ribs nearly touch each other on the right side.

Specimen 4th. — In this, the curvatures are slight, and is noticed for the purpose of stating the fact, that the ribs on one side measure two inches in length more than the other; but in the living, I have seen this disproportion of the costæ in length amount to three and four inches.

The sternum was drawn to the left side.

The apparent abolition of the distinctness of articulation of the vertebral joints in the third specimen, is an exception to the general rule, yet the portion of the spine thrown transversely, appeared to be partly made up of intervertebral substance. From the inflections of the spine, described in these specimens, and from that portion of the vertebral column connecting the two curvatures, taking a transverse instead of a perpendicular direction, it is evident that the spine is shortened and the capacity of the thorax diminished, both by the shorter dimensions of the spine, and by the ribs coming in contact with the bodies of the vertebræ; the growth of the lungs must be impeded in the ratio of the diminished capacity of the chest, and are consequently smaller than natural, and the large blood-vessels and thoracic duct must be much shortened, if they do not follow the serpentine course of the vertebræ, in the ratio of the diminished length of the spine, and if they do follow it, they must take a tortuous course, and be also diminished in length, in the degree the column is shortened by the reduced breadth of the vertebræ. The spinal cord is compelled to assume a winding course, and the nerves arising from it consequently deviate from their natural directions; I have never seen a case in which the foramina for the exit of the spinal nerves were obliterated.

The above and several other valuable specimens of lateral curvature may be seen in Mr. Brooke's excellent museum, and to this learned professor and unwearied cultivator of the sciences of anatomy, surgery, and natural history, the author begs to express his cordial thanks for the kind and liberal spirit with which he promoted his investigations, by placing all the specimens of morbid anatomy of the spine in his museum at his disposal, and by giving him every facility and assistance in acquiring a knowledge of them.

No particular notice has been taken in this section, of the immediate causes of the contortion or serpentine turn of the spine, and I would merely state that it seems referrible to malformation or irregular growth of the vertebræ or of the ribs inserted into them. Dr. Dods attributes it to unnatural action of the spinal muscles. "I consider contorted spine," says Dr. D., "to be an affection, totally independent of any disease or diseased action, either in the

vertebræ, or in their connecting ligaments or cartilages, and that it is produced, in every instance, by a peculiar affection of the muscles of the back, which does not, primarily and necessarily, unnaturally crook or curve the spine in any direction, but rotates or twists it in the line of its axis.”* This doctrine is entitled to originality, but is not true to Nature’s laws. The actions of all muscles are ordained for particular purposes and regulated by positive laws. They have a healthy and a diseased action; in the former, they obey volition; in the latter, they act spasmodically; but the *direction* of their contractions is the same in both, and the motion or effect produced is the same. A muscle solely appointed to elevate and extend, cannot be made to perform rotation of a part. The spine has not any muscles of rotation. No such power is assigned to them by anatomists. Whence, then, can they derive the morbid action, or power of rotating? I confess it seems to be an impossibility to rotate the spine by muscles appointed only to elevate and extend it, and without muscles for the purpose of rotation, such as are placed about rotatory joints.

Before entering on the treatment, an advantage may be derived from pointing out some methods of ascertaining the degree and course of the curvature, and if the spine be free from ankylosis or inflammation. In the generality of cases, the degree and form of the curvature are evident, and can be distinctly traced by the eye or the fingers. If not, and it is desirable to ascertain the precise degree of curvilinear deviation, “a plumb-line may be suspended opposite the middle of the occiput, whilst the patient stands in the first position of dancing-masters, which will hang perpendicular to the centre of the pelvis, and the deviations on each side of this line can be marked with red or black ink.^a Having thus ascertained the degree and form of the curvature, we may endeavour to discover what changes can be effected in the distorted position of the vertebræ, and what approximation can be made to the true spinal line. Let the patient first raise himself as erect as possible; he should then perform flexion and extension of the vertebral column; the spine should next be stretched in the recumbent posture by assistants; and lastly, let him be suspended by the head, with weights to his feet, in the manner already described at p. 91. If the curves be diminished by these evolutions; if the spine be brought by them to a line nearly straight; if all the vertebræ change their position and perform some degree of motion; it may be inferred there is no ankylosis. If no pain be excited by those movements, the absence of inflammation may be deduced,

* [By forcibly pressing the fingers against the spinous processes of the vertebræ, a red blush is produced which sufficiently marks the course of the curvature.—ED.]

and the prognosis may be favourable. But if the lateral distortions cannot be lessened by these evolutions and mechanical contrivances, the favourable issue is uncertain, and the patient should not be buoyed up with fallacious hopes of a perfect recovery, that will be most probably disappointed; and if pain be excited, the prognosis should be guarded, as the termination of spinal inflammation is not always subject to remedial control.

CHAPTER VIII.

SECT. I. — *Treatment of Lateral Curvature.*

THE treatment of lateral curvature embraces a subject of great importance to mankind, and to surgeons, which has not yet received a consideration, in any degree commensurate to its consequence; I mean the disproportionate growth, and irregular development of the bony structure of the body, including their effects in producing deformity and distortion. Some allusions have been made, and explanations offered on this subject, in the course of this treatise, and as my mind has been awakened to it, it shall not be lost sight of in future. At present, it occasions the consideration of the subject to be comprised under two heads. *First*, where the curvature arises from the disproportionate length of the lower extremities, altering the natural centre of gravity of the body, and throwing the spine off its true spinal line. *Secondly*, where it arises from any other cause except the one mentioned. In the first case, it is evident, *primâ facie*, that the cause must be removed or remedied, or its effects obviated, before any permanent cure can be expected. From the records of surgery, information is not to be gained on this point, nor can my present experience enable me to determine the precise time Nature will take to reform her malformations, or aberrations of growth; but it is satisfactory to be convinced that her efforts will be directed to the accomplishment of this desideratum, during all the future development and growth of the body. Where the lateral curvature arises, during the growth of the body, from one extremity being shortened, by the ankle or knee joints bending either outwards or inwards, in consequence of the relaxation and weakness of their ligaments, or of the rickety growth of the heads of the bones forming the joints, these states can be remedied, by wearing the apparatus particularly constructed for this purpose, and on the extremity being restored to its natural dimensions, if the lateral curvature has only been slight and incipient, it will generally recover, provided pains be taken to maintain the body erect in sitting and walking, and this exertion be aided by friction and pressure on the back, and extension of the

spine. Appropriate internal remedies should be combined with the mechanical means, in order that any defect or disease of the constitution may be remedied.

An inequality of the length of the extremities may be produced by the blighted or diminutive growth of one of them, which will dispose to a lateral curvature; in this case, the patient should wear the instrument made by machinists adapted to such instances, which places the body in equilibrium; and if he be young and growing, friction, exercise, warm bath, and stimulating liniments may be used a long time, with considerable success, in promoting its future increase of growth, and in restoring its equality of length.

When the inequality of length and size of the extremities arises from an extraordinary development of one of them, the lateral curvature is more frequently occasioned by it, than any other cause of disproportion. The effect from this cause may be obviated, by wearing a shoe on the shorter extremity, with a sole as much thicker as the other extremity is longer, by which the body will be placed in equilibrium, and both extremities brought on a level. In all instances of this kind, the fact of one extremity being really longer than the other, should be carefully ascertained, and distinguished from such in which there is an apparent difference only.* The lateral curvatures, formed by all the deviations of proportion of the extremities enumerated, result from the necessity of maintaining the centre of gravity, by bending the spine to one side, so as to keep the whole frame in somewhat of an upright attitude.

There is another cause of disproportion of the extremities, tending to the same result, viz., the loss of the natural arch of the foot formed by the tarsal bones; but this malformation is rare, and may be remedied, so as to prevent its effects on the spine, by apparatus to support the tarsal bones, and retain them in their natural situations.

If the curvature induced by any of the changes of structure of the lower extremities be slight and incipient, the patient will, in all probability, soon recover from it, after the different contrivances for obviating the effects of those changes have been adopted; and, at all events, if he does not, the recovery can be aided by extension, pressure, and wearing a spinal machine with lateral and axillary supports, to prevent the spine from inclining to one side. When the curvatures have become extensive, additional means must be used. Although the contrivances, to obviate the effects on the spine of the unequal length of the lower extremities, may cure the curvature, yet they may be objectionable in the cases arising from the increased or diminutive growth of one extremity, because they will tend to oppose that degree of subsequent growth of the shorter extremity, by which only the equality of length can

* This difference is scientifically explained, by Mr. Shaw on Distortions, p. 226; in the other instances of disproportion I have mentioned, the difference is palpable.

be re-established. In the cases where the use of these contrivances excites apprehension of the unfavourable result just stated, it is a safer practice, both with a view of obviating lateral curvature and the effect of any measure that tends to check the growth of the diminutive extremity, to interdict the use of mechanical contrivances to the extremities, and the employment of the erect attitude, and confine the patient to the recumbent or sitting postures, so as to take off all weight from the extremities, until it be ascertained how far Nature will repair her own defects from faulty growth, and restore the natural proportions of form, than to adopt a plan that would oppose it. The confinement would be tedious, and of long duration; but this would be preferable to a distorted, stunted and sickly frame for life; and it is gratifying to recollect we possess an available alternative, where the patient cannot be reconciled to a perseverance in these postures.

During the use of the horizontal or sitting postures, the shorter leg can be conveniently exercised in flexion and extension; and friction, percussion, shampooing, local warm bath, and extension, can be much employed, by which a larger determination of blood and a greater generation of animal heat will be created, both of which have been found to conduce to its more regular and complete development. As the unequal length of the bones of the extremities and the unequal thickness of the bodies of the vertebræ, in lateral curvature, originate, in general, in the growth of these bones being influenced by the rickety diathesis of the constitution, this state must be corrected, or removed, before Nature can remedy her deviations of structure, and the bones must have acquired their natural hardness and proportion of earthy matter, before any remedy can be rendered permanently useful. To attempt the fulfilment of these objects, I have commonly directed the use of the cold bath, either generally or partially, to the back or extremities, to be followed by friction; and I have prescribed chalybeates daily, with rhubarb aperients twice a week, whilst great attention has been paid to a plain and strengthening regimen in diet, and the digestive functions have been well regulated. The patient, in this case, as in the other species of curvature, should go, or be carried, into the open air, as often as is compatible with his situation.

It has been already shown, that if the erect attitude be persevered in whilst this disproportion of the extremities continues, without a contrivance to obviate its effects, the curvature will increase to an almost unlimited degree, which clearly evinces, that if the object of removing this deformity is to be fulfilled, the patient must avoid the ordinary use of the erect posture, in walking or standing; but whilst sitting, the vertebral column may be preserved upright, in the incipient stage, a circumstance constituting a difference between a lateral curvature from this cause and any other, in the first instance; and, in the sitting posture, the spine can be balanced, by a weight borne on the head, as recommended by Messrs. Grant and Wilson, or the dorsal muscles exercised by

any of the various modes described at page 79 *et seq.*, to be available in the sitting posture, with the pelvis fixed, and which are calculated to exercise the spinal muscles in particular, or the muscles arising from the trunk, scapulæ, and clavicles, and inserted into the humerus, or which combines the action of all those muscles. To these may be added, modes of exercise suggested in a subsequent part of this section, and those that can be performed whilst lying. The frequency of repetition of this exercise of the muscles must, of course, depend on the patient's strength, and on their utility. After each effort, it is advisable to take rest, by lying down on a couch or sofa.

The mind, on reflection, will soon admit it as a satisfactory inference, that neither setons nor issues can be of any advantage in this variety of lateral curvature, for how could a purulent discharge in the line of the vertebral column effect an alteration in the growth of the femur or tibia, or in the relaxation of their ligaments? In a withered lower extremity, or blighted growth of it, I have seen them thus employed, without communicating any disposition to vigorous growth. It must also appear equally clear, that carrying a weight on 'the head, or either of the modes of exercise above referred to, employed whilst the patient stands erect, or walks about, cannot tend to remedy this curvature, when it is the consequence of disproportionate length of the lower extremities, for the vertebral column must, of necessity, be curved laterally to preserve the centre of gravity.

Time, medical remedies, and gradual processes of nature, may remedy this faulty growth, but it must be consigned to time, for by what process can we partially repress the growth of a whole limb? Can we by restraining its exercise? I fear the attempts must be futile; whilst, however, we may, with more certainty, promote growth by the means already recited. Still it is the business of surgery to recommend the disuse of any attitudes that throw the body off its natural axis, and occasion unequal pressure on any portion of the vertebræ. Hence it is, that the recumbent posture, and exercise of the back in the sitting posture, are not only more useful than any of the modes of treatment by exercise, in lateral curvature, arising from this cause, but experiment has proved the use of the former to be superior to either plan, in some cases not originating in it, as will be exemplified in the sequel. Let us, at present, proceed to the consideration of the treatment of lateral curvature from other causes.

When the lateral curvature has arisen in a young girl, from carrying a child; or a youth any heavy weight, too constantly on one arm, during the growth of the body, which weight they are unable to support, without deviating from the erect posture, and bending the body, so that the head and neck are inclined over to the side on which the weight is carried, and the dorsal part of the spinal pyramid is bent to the other side; the practice should be instantly discontinued, and if the curve be slight, the patient should adopt

the plan of carrying a weight on the head, combined with marching in the military attitude observed by recruits during the period of drilling, with their heads up, shoulders braced back, and the thumbs carried to the middle of the thighs ; and she should resort to the exercises that move the muscles of both arms, and both sets of spinal muscles in an equal degree ; when fatigued, especially if the dorsal muscles feel so, the patient should seek horizontal rest. The weakness of the body should be counteracted by tonics, chalybeates, a nutritive diet, and regular hours of exercise and rest. The patient might try the experiment of the effects of carrying a weight on, or inclining the body to the other side.

Mary Mansell, aged eleven years, 15, John Street, New Road, was affected with lateral curvature, from the above cause, Nov. 21st, 1821, and was discharged cured, by the means just mentioned, on April 12th, 1822.

When incipient lateral curvature arises from the malposition of artists, they should draw and paint in the erect attitude, and should have recourse to the exercises advised for the sitting and standing postures, p. 79 *et. seq.*

When it originates in the habit of sleeping always on the same side, or of sitting on the same side of the fire, or window ; let the patients instantly change sides in bed, &c., and be directed to use appropriate exercises and mechanical contrivances. Mr. Green, of Bury Street, related to me the cases of two young sisters, in whom lateral distortion arose from sleeping always on the same side in bed, one towards the right, and the other towards the left side, and who, on changing positions, soon recovered ; the younger in three months, and the elder in six.

It has appeared to me desirable, that the exercises in general directed for lateral curvature, should call into action, *in an equal degree*, the spinal muscles on each side of the spine, the muscles on both sides of the trunk, and the muscles on both arms, as such modifications of muscular action have a tendency to reduce the spine to its spinal line. Thus, flexion and extension of the spine, exercises equally the spinal muscles. The muscles of the trunk and arms may be exercised in an equal ratio, in the sitting or standing postures, by placing the body between, and turning two wheels, fastened to a frame, or door-posts, with handles that have levers of the length of the semi-diameter of their circumference. The wheels may be of various sizes, and fixed higher or lower on the frame, as in proportion to their weight, will the muscles be exerted ; and the levers may be of various lengths, as in the proportion of their length, will the body be obliged to perform greater or less flexion and extension in their rotation. If the latter should be small, let the lever be short ; if flexion and extension of the spine should be considerable, let the levers be long. This mode of exercise either in the sitting or standing position, is applicable to lateral curvature from all the causes already enumerated, and is, in general, very useful, where exercise is proper. Light dumb bells may be used.

Weak young ladies and boys, who are made to sit for long pe-

riods on stools or benches without any support to their backs, as on school benches or in learning music lessons, and who are obliged to assume the attitude of easy grace of some ancient statues, as of the Venus de Medicis or Antinous; but which is one of incipient lateral distortion, should be accommodated with a chair with a properly formed back, and the strength of their muscles should be increased by the institution of the exercises recommended in the sitting and standing postures, whilst their general health and strength should be promoted by tonics, regimen, and good air.

When it arises from an irregular and disproportionate growth of the vertebræ, which rickets so frequently disposes them to assume: in the incipient stage, I have attempted to remedy it by the modes of exercise so often adverted to, but it must be confessed that such success has not been derived from this practice, as I was induced to expect from the high authorities and character of those who have recommended it, perhaps from their having advised it too generally, without being influenced by the discrimination the remote or proximate causes suggest.

Well knowing how often experience appears to be at variance with reasoning *a priori*, both in medicine and surgery, I have not failed to try experiment where reason has been opposed to it. It has been already explained, that when the bodies of the vertebræ have grown or become of a cuneiform shape, instead of their sides being of equal depth, that such a formation and disposition are incompatible with a proper observance of the erect attitude, and must dispose them into the form of a curve; hence it is, that the propriety of employing exercises in the erect posture, with cuneiform vertebræ and a curved column, during the progress of the disease, stands opposed to the conclusions of experience and accurate reason; because, in that posture, the cuneiform vertebræ are subjected to undue pressure, more particularly about the centre of the curve, which would increase the curvature, by promoting the further absorption of the thinner side of the vertebræ now bearing all the superincumbent weight. At all events, exercises in lateral curvature from the above cause, have decidedly failed,* so that I always adopt the recumbent posture, and deny the patient the privilege of sitting up, allowed in lateral curvatures from some other causes.

The following case may forcibly exemplify these statements: W. Williams, aged 16, Cleveland Street, Fitzroy Square, had observed a lateral curvature with the convexity to the right side during some months. On the 16th January, 1822, he was examined. The curvature was single, and embraced eight of the dorsal vertebræ, from the second to the ninth inclusive. The

* If the disproportion of the sides of the vertebræ be small, and consequently the curvature be slight, and the patient can place the spine erect, soon after he begins to walk, the spine sinks down and inclines to one side.

centre of the curvature inclined from the spinal line to the right, half an inch, in the erect attitude, and the vertebræ were turned or twisted a little backwards on that side, so that the right ribs and right scapula projected backwards and formed a misshapen hump. The dorsal portion of the vertebral column also protruded a little posterior to the spinal line, and, when erect, the head and neck appeared to incline forwards. On measuring across the back, the distance from the middle of the spinous processes of the distorted portion of the spine to the side of the body, was five inches on the right, and six inches on the left; but the semi-circumference of each half of the thorax, from the spinous processes to the centre of the sternum, measured the same; a circumstance clearly evincing, that although the ribs on one side were, in situation and form, arranged differently from the other, yet they were of the same length. Dyspnœa was induced, but his general health is not much affected.

The left extremity was nearly one inch longer than the right. A cure of this curvature was attempted by a combination of various modes of exercise of the dorsal muscles, with military marching and improving the general health, until May, when no amendment having taken place, he was then enjoined the obliquely lateral horizontal position; that is, whilst lying on the back, he was directed to lie either obliquely lateral on the portions of the ribs most projecting backwards, in which position the superincumbent weight of the body pressed them forwards and the distorted spine to the centre of the back, or whilst lying on the face, to lie obliquely on the anterior portions of the ribs on the left side, whilst a dosser, made of sheet-lead, weighing from 14 to 20 pounds, and modelled to the shape of the distorted ribs, was laid on their hump or protruding portion, which directed the ribs anteriorly, and the curved portion of the vertebral column into its spinal line.

Extension of the spine was employed frequently every day, during which pressure was made on the projecting portions of the ribs, and on the spinous processes in such directions as tended to restore them to their natural situation. Exercises in the recumbent posture were employed. P. 86. A bandage was also worn around the chest. His general health was promoted, and by these means he did not recover till June, 1823; after February, 1822, he gradually returned to the use of the erect posture, and exercises in the erect attitude. The spine became straight some months before the projection of the ribs was reduced.

If then it be admitted that the comparative value of the modes of treatment be sometimes in favour of a particular recumbent posture, when the curvature arising from rickets is in the incipient state, and the spine only deviates from the straight line into the form of an Italic *f* (s), very little doubt will be entertained of its superior value and propriety, when the lateral curvature has been neglected or maltreated, from whatever cause it may arise, until it has assumed the form of the Greek, ζ sigma. For, in the latter

cases, all the medical and mechanical means that reason can suggest and experience sanction, should be assiduously employed to obtain even a chance of complete success. Proper position, extension, pressure, friction, exercises in the recumbent posture, &c., are among the natural and mechanical aids. There are two positions for common use of almost equal advantage, and they are both obliquely lateral, on a horizontal plane or couch, made for the purpose, and covered with a mattress; hence, the patient should be directed, either to lie obliquely on the side on which the ribs protrude backwards, or, in plainer words, to lie on the hump, as the superincumbent weight of the body bearing on this projection will be equivalent to a certain degree of constant pressure, that tends to press those ribs forwards, and to direct the convexity of the spine towards the spinal line; or, he should be enjoined to lie on the face with an oblique direction to the opposite side, so that a dosser of lead, modelled in some degree to the shape of the distorted ribs or hump, and varying in weight according to age, or a bag of shot that will assume the turn of the ribs, may be laid on the projection so as to maintain a constant pressure, with the same indications as in the last position.

When the curvatures are ambilateral, the positions may be changed from one side to the other.

The spine should be kept as long and as often extended, by mechanical contrivances affixed to the cross pieces of the couch-frame, or by persons pulling at the extremities, as the patient can conveniently endure. Some degree of permanent extension or for a long period, can be effected by the patient applying Dr. Darwin's steel bow to the head, whilst he lies on an inclined plane, with or without weights appended to his feet. P. 92. The moveable inclined plane of Mr. Shaw, is equally applicable, and its use is equally advantageous. P. 87. Temporary extension may be employed with the windlass, as described at p. 92.

During extension, the surgeon, or some one under his direction, should, for half an hour or one hour or more a day, employ pressure with his hands on the curved portions of the spine and on the projections of the ribs; with his thumbs placed against the sides of the spinous processes, on the convex side of the curve, he can press the vertebræ towards the spinal line, and, by laying the palms of his hands on the backward costal projections, he can press them forwards, and, by giving a lateral direction to the pressure, cause the vertebral extremities of the ribs to aid in directing the distorted vertebræ to their natural axis. Where there are two or three curvatures, a person may act on each side.

Friction and shampooing I have found profitable, and they may be employed at all convenient opportunities. The patient should not be allowed either to sit or stand upright, as it is as necessary to free the spine from all superincumbent weight in these cases of ambilateral curvatures, as it is in excurvation, and to keep it perpetually exempt from it; so that the particular horizontal postures

recommended, should be constantly observed, and it is some consolation that a variety is allowable. To prevent the spine from bending during sleep, the patient should wear the bandage, pad, and shield, at night, or "a pair of stays;" but the use of the steel bow does away with their necessity. He should use all the modes of exercise available in the lying posture. P. 86 *et seq.*

By having recourse to exercises, the spinal muscles and those of the trunk are preserved from inaction and debility, as much as possible. The exercises can be a little varied by the position of the patient being altered, and will differ as he lies on his face or back. In the latter, he can exercise the muscles of the trunk, by pulling at the cords passed through the pulleys of standards fixed to the ends of the couch, and he can perform flexion and extension of the extremities and throw out the legs. The spinal muscles will be exercised by the use of the moveable inclined plane. Whilst lying on the face, the patient can exercise the muscles of the neck and upper part of the back, by throwing his head backwards and forwards, and he can rotate his arms, and pull any ropes affixed to weights and pulleys placed before him.

It has been observed, that the intercostal and abdominal muscles are contracted or shortened on the concave side of the dorsal curve, and although they might be stretched and the ribs separated in a slight degree, by the modes of extension and the exercises recommended, yet it is desirable that more varied and efficacious means should be devised and used. The patient should dilate the chest by frequent full inspirations. The use of the chest dilator, described at p. 85, is calculated for the purposes of separating the ribs and stretching those muscles. At the same time, the ribs might be lifted up separately, after the manner of the shampooers, who effect it by getting their fingers under the lower edges of the ribs and raising them up. The patient might be laid on the convex side of the dorsal curve, across some pillows or a circular frame made for the purpose, with the head and lower extremities bending over, in which position, the intercostal muscles would be put on the stretch, and the ribs separated on the opposite or concave side of the curve. This position will be rendered more efficacious if the arm on the concave side of the curve were raised over the head and moved up and down, whilst a little pressure was made on the spine of the ilium of the same side. Mr. Shaw thinks the following mode the safest and most effectual; which is effected by a modification of the moveable inclined plane, described at p. 87 *et seq.* — "A common pillow may be substituted for the socket upon D; the boards C and B are to be arranged in the same manner as for lying on the back. The patient should turn a little on the right side; the left hand is to be raised over the head, and, by taking hold of the upper part of the sofa, or of a strap, she should endeavour to pull herself up. In doing this, it is evident that the ribs of the left side, which are squeezed together (being on the concave side of the curve), whilst the lumbar portion of the spine

is still kept fully on the stretch by the receding of the board B. When the patient is fatigued by the attempt to pull herself up, which requires considerable exertion, she ought to rest for some time, supporting herself by the left arm."

Dyspnœa is a troublesome symptom in the advanced stages of lateral or ambilateral curvatures, and continues during life, if the curves be not removed; the most effectual relief I have found for it, is lying in the oblique position on the projection I have described, which tends to enlarge the capacity of the thorax and the power of expansion of the lungs, and to obviate the compression the lungs are subject to from the backward projection of the ribs and their approximation to the vertebræ.

A gentleman of great acuteness and intelligence and much mental energy, who consulted me on account of lateral curvature, assures me that he invariably finds relief from dyspnœa by lying down on the costal projection which I recommended to him, and he is of opinion, from personal experience, I cannot attach too much importance to the inculcation of the observance of the oblique lateral position, in this species of distortion.

The particular recumbent posture recommended, is also the best remedy for the cure of nervous symptoms, resembling chorea sancti viti, irregular actions of the muscles, fits, pain of the head, and spasmodic affections of muscles, as of the extremities, eyes, &c., with which tonics, chalybeates, and aperients may be combined.

Mrs. Lee's child, 13, Ranelagh Street, Pimlico, whom I had an opportunity of seeing, through the kindness of Dr. James Johnson, had a slight lateral curvature directly to the left side, and was affected with spasmodic actions of the muscles of the extremities and eyes, and, very frequently, had fits in the night; his general health was bad, and he occasionally fell down suddenly when walking; he was directed to use the facial horizontal position, and chalybeates with a rhubarb aperient twice a week were prescribed; by these means all the symptoms arising from nervous irritation soon ceased; after a few weeks and before the spine had recovered its proper line, his parents allowed him to run about, and the spasms and fits returned periodically; he was again enjoined the same position, and took a nauseating dose of antimony and ipecacuanha prescribed by Dr. J. every night, before the accession of the epileptic paroxysm, and after the second night, the fits did not recur, and he perfectly recovered.

In the majority of cases of lateral curvature, the medical treatment has been the same as if the patient had been affected with rickety growth of any other part of the body; hence, chalybeates, rhubarb aperients, tonics, and the cold bath, general or topical, have been commonly prescribed.

If pain has arisen in any portion of the spine, local bleeding and blisters have been used, but they are not often indi-

cated. In the rickety variety, issues and setons are not necessary.

When a lateral curvature exists in the cervical vertebræ, endeavours have been made to obviate it, and take off the pressure from the concave line of curve, by directing the patient to lie on the convex or opposite side, and by elevating the concave side by a graduated pad, passed and retained under the inclined side of the head and angle of the lower jaw, whilst the cervical vertebræ were extended, and the head passed over to the convex side. The head may be kept raised a little, and the cervical vertebræ extended by the back-board or collar, with the forked rod that passes under the chin, and supports the head; in this case, the apparatus may be concealed.

The collar or back-board, with the curved steel rod may be used, in the manner already described, for the same purposes, and for producing some degree of extension. When the patient is lying on an inclined plane, the steel bow may be employed.

It has been stated that scrofulous inflammation, ulceration, and caries have been known to destroy the lateral portions of the vertebræ and intervertebral substance, and the spinal column being deprived of its natural support on either side, must incline on that side, so as to form a lateral curvature. Although this case is of very rare occurrence, yet it is of great importance, because it is the variety that has a direct tendency to destroy life. In this case, the pain is felt in some portion of the curvature, both on mechanical pressure on the part, and on the patient using exercise in the erect posture, which induces him to assume the recumbent position; the patient sometimes experiences acute lancinating pains of the back, and screams in his sleep; in lateral curvature, from rickets, &c., the patient very seldom complains of pain, or seeks the recumbent posture, nor is it excited by the mechanical means of cure; in the scrofulous variety, the general health usually suffers from the first, or if the appetite and digestive functions be not remarkably disordered, yet the nutritive functions is impaired, and the patient becomes emaciated, pale, irritable, and weak.

After the ulcerative process is established, and the bone becomes carious, and the intervertebral substance and ligaments partake of the disease, and pus collects behind the mediastinum or peritoneum, and perhaps makes its way to the surface of the body; the pains increase, hectic fever is induced, the patient cannot bear an erect attitude, emaciation advances, and the patient dies. In such cases, local counter-irritation, and remedies for subduing local inflammation, should be employed; issues, setons, leeches, cupping, blisters, are all useful. I have found gentle alteratives and a daily hydragogue aperient the most useful medicines in the inflammatory stage. A diet of easy digestion should be prescribed. After

the suppuration, that system of treatment that is best calculated to support the patient should be adopted.

A recumbent posture should be enjoined in the inflammatory stages, in the state of caries instinct prompts it, and extension and pressure should be so gentle as not to excite pain.

After the recumbent posture has been long observed, the same caution and rules should be observed when the patient begins to assume the upright attitude and exercise, as have been laid down for the guidance of patients who have been affected with excurvation. The same alternation of exercise and rest, and of the upright and recumbent positions should be attended to, and the use of instruments to support the spine must be employed on the same principles and grounds of propriety.

In the very early stages of this disease, when the curvature is directly lateral, and there is no pain or tortuosity of the spine, a cure may be attempted, without having recourse to the recumbent posture, by proper exercises of the dorsal muscles and those of the trunk; by wearing the spine machine or collar, with lateral and axillary supports, and the rods for supporting the head, as often as the patient uses the erect attitude, and by the remedies employed for the cure of rachitis. This instrument shall be worn in all cases, whenever the patient is obliged to assume the upright posture, and if a cure cannot be effected, this instrument, varied for particular purposes, must be worn. If instruments be injurious at all, they must be so in curvatures attended with rachitis, when the bones are soft and yielding. I, therefore, revert to the subject of the use of instruments. As all the spine instruments embrace and rest upon the pelvis, as their basis of support, they have been objected to by many eminent surgeons, whilst their employment has been defended by others, and great authorities may be quoted on both sides of the question.^a The bad effects are attributed to a weight or burthen being thrown on parts never intended or calculated to bear them, by which the pelvis is irreparably distorted, and females suffer, during parturition, from pelvic deformity, preventing or retarding the passage of the fœtus.

Their good effects are derived from taking off weight from parts predisposed to be disorganized by undue pressure, and keeping the spine erect. The latter are positive good; the former appear to be evils too much overrated, and the effects not *distinctly* proved to arise from the use of instruments, in any case; they are inferred from the sometimes erroneous maxim of *post hoc, ergo propter hoc*, a maxim rather incautiously admitted as true in the instance under consideration. During the existence of a rickety diathesis, it seems to be a correct fact to state, that there is no law belonging to rachi-

* [No such objection applies to the spine-car of the editor, and the spine-chairs of Darwin, Shaw, and Kissam, as they do not throw the weight on the pelvis.—ED.]

tis which limits its influence to any particular bones ; all the bones are subject to its influence, but different bones are affected in different persons ; in many, the extremities are bowed and deformed ; in others, the spine is curved ; and, in a few, the bones of the pelvis are distorted ; but it seldom happens that the pelvis is distorted when the spine is curved, and not often that the spine is curved when the extremities are bowed.

It will be proper to consider if the bones most implicated in deformity of the pelvis, whose distortion prevents or impedes parturition, are those most subject to pressure from spinal instruments. The superior aperture of the pelvis is the most common seat of distortion, and this more particularly arises from the 5th lumbar vertebræ and the upper part of the sacrum projecting inwards. The os coccygis may be pressed inwards ; the sacrum may be too straight ; the ischia may be distorted by an unnatural bend of their spinous processes ; or the tuberosities of the ischia may be bent inwards or forwards, or the ossa pubis may be curved so as to diminish the superior aperture ;—and, by all those deviations of structure, the passage of the fœtus through the pelvic apertures is obstructed.

Does the spine instrument press upon any of the particular parts enumerated ? it certainly does not, — as its particular pressure is made upon the spine of the ilium, and it does not touch the sacrum, os coccygis, or tuberosities of the ischia ; and the pubis is only crossed by the strap, or is not touched at all. Again, the part of the instrument embracing the pelvis is made to fit its natural shape, and must rather tend to preserve its form than occasion its distortion ; besides, as the greatest pressure is on the sides of the pelvis, this would tend to widen the space between the ossa pubis and sacrum, and preserve the pelvis from deformity, rather than to occasion that obstructive diminution of it which is usual in distortion of the pelvis. Still, there is a way by which spine instruments may do injury ; for as those instruments are generally worn during the growth of the body, if an instrument adapted to the size of the pelvis at one age be continued in use until the patient be older, and the dimensions of the pelvis larger, it may repress the growth of the ilium, and alter its conformation. In no other way does reason point out its injurious effects ; but I would observe, that I have seen some spine instruments of Mr. Cheshire, that are more ponderous than necessary, and far exceed in weight those manufactured in London. I cannot, therefore, perceive how the latter can do injury, if the precaution of adapting them to the successive growth of the bones be observed.

Analogy is in favour of the use of instruments in rickety distortion. In the distortions of the lower extremities from rickets, that is, in the cases of “ knock-knees,” whether bent outwards or inwards, or in those of the inverted or everted ankle-joints, or where the shafts of the large bones are much bowed, the use of iron instruments with moveable joints corresponding with the situation

of the natural joints, may somewhat confine the action of the muscles, but their constant employment assists in reducing the heads of the bones of the joints to their proper shape and size, restores the joints to their usual play, and imparts a natural direction to the bodies or shafts of the bones. There is, however, a difference in effect between the use of the collar and of those instruments to the extremities. The latter offer but little impediment to the due exercise of the muscles of the extremities, whilst the collar almost wholly prevents the action of the spinal muscles. To render the effect analogous, and as advantageous, the spinal muscles should be exercised by all proper means, at intervals that the collar can be taken off.

The instruments should not be made to press on the ribs, or the costal or scapular projection in particular, as such pressure never does any good, but may increase the deformity.

It has of late been urged as an objection to the long continuance of the recumbent posture, that it produces a soft state of the bones; I must not doubt such statements, but I cannot help observing, that I have had many opportunities of examining persons who have died after having been many years bed-ridden, and I have not witnessed in them a soft state of the bones, nor such as is observed in rachitis. Were this a general fact, in no species of curvature would recumbent posture be so properly objectionable, as in the lateral one; nor could the rickety diathesis be expected to be cured during its use, but every day's experience refutes such a conclusion.

"It may be stated as a law of the animal economy," says Mr. Shaw, "that *the active exercise of an organ is necessary not only to its perfection, but even to its preservation.*"* This is often exemplified by the state of the parts which are not kept in due activity; for, if they are not exercised, they degenerate, so as even to lose their peculiar characters, and gradually to become similar in structure to the common cellular membrane." From this it is inferred that the cellular texture is not only the original matter in which bone, muscle, and nerve are deposited, but that from which other parts are formed. If it had been assumed that the exercise of an organ is necessary to its functional perfection, it would have met with a general concurrence; but when it is added that it is necessary to its preservation, that is stated to be a law of the animal economy, which will not be readily assented to. The experienced physiologist will have observed many instances of persons, who, from obesity and corpulence, have, for years, been deprived of the due activity and exercise of their muscles, especially of the lower extremities, in whom the muscles have not wasted, the bones have not been softened, and in whom, the bursæ, capsules, and ligaments, do not form one indistinct mass of cellular substance. He will have seen many, who, from advanced age or

* See p. 1 and 46, on "Distortions, by John Shaw."

infirmities, have been bed-ridden for ten or twelve years or more, and have been necessarily inactive, and yet the muscles, bones, joints, and their constituent parts, have been preserved, and show their external character and uses every distinctly. In the case of Ann Selby (*See Chap. on Spina Bifida*)* all these parts were organized, preserved, and distinctly cognizable, and might be stated to be perfect, except the spine, although they had never been kept "in due activity," and hardly used at all from her birth. If "the active exercise of organs were actually necessary to their preservation," wo be to old maids and bachelors, nuns and friars, and the barren, for their genitals must be converted to fat. Wo to the man affected with inactive obesity, for he must become a mass of "common cellular membrane."

The pathologist will urge that the eye of the child, born with congenital cataract, which may not be subsequently exercised in vision for a few years, is still in a state of preservation, and may have its visual function restored by couching or extracting the crystalline lens, and so may the eye of the adult, after a cataract has existed for some years. The man long confined or chained in a dark dungeon, on being restored to light and liberty, finds the exercise of vision and of his muscles painful, but not lost. He will state, with truth, that the organs of hearing and speech of persons deaf or dumb, although not at all exercised for long periods, have been restored to their sense of hearing and speech, which proved them to be in a state of preservation.

It will be allowed, that action of muscles is necessary to preserve their strength; and that *inaction of muscles, during disease*, as of the lower extremities during scrofulous inflammation of the knee-joints, *produces wasting or absorption of the muscles*. The pathologist will allow that a joint may become ankylosed and its parts changed, but he will maintain that it is the result of a morbid action, as of chronic inflammation, implanted in the joint, and will deny that this is the sole effect of disuse. He will allow that the sockets of bones may be wholly changed and obliterated after permanent dislocation; but this is for a wise purpose, and not the sole effect of disuse. The motion of joints may be lost by the permanent contraction of muscles, but even they do not necessarily ankylose. There is a man of the name of Gass, in Covent Garden Infirmary, the state of whose extremities illustrates the effect of inaction in a healthy, and in a crippled or diseased member. Ten years ago, he fell down, and, as he supposes, dislocated the left femur at the hip-joint, the extremity of that side is shorter than the other, and he has never walked since; for the last six years he has never been out of his room, and has scarcely moved his lower extremities. The muscles of the left, or injured extremity are wasted, and the thigh is about half the circumference of the other, which is occasionally ulcerated. The right extremity and all the other parts of the body are muscular, and the man looks stout and

* See also p. 55.

robust, except in the injured limb. Surely then, the wasting of the muscles of the left limb is attributable to inaction, under disease or injury, and not to mere inaction; as, were this the case, the left extremity would be equally withered.

In all the cases of softened bone, mentioned by Mr. Shaw in his valuable work, at p. 6 *et seq.*, the bone had been either wounded, fractured, or dislocated, and had, consequently, been subject to diseased action, and the osseous condition had not been changed by mere disuse, whilst the body was in health. Does not a solid bony union of fractures take place during the motionless quiescence and perfect inactivity of the limb? Teeth neither decay nor waste, nor become soft from disuse, as where those opposed to them in the opposite jaw are drawn; but they enlarge and retain their hardness.

Case. — Mrs. Heap, of Maiden Lane, had an ulcer of the right lower extremity, extending from above the knee to half way down the tibia, which had continued for twelve years; appeared to be of a constitutional character, and had necessarily subjected it to inaction. On her decease, I sawed out equal portions in length of both tibiæ. Their weight was the same; the circumference of the right tibia, over which the ulceration had existed, was a line more than the left, and it possessed an equal portion of earthy matter, so that the bone had not been affected either by the ulceration or inaction. The periosteum had been inflamed and was thickened. The side of the gastrocnemii in contact with the bone was paler than on the sound leg; but as the ulcered leg was œdematous, it might have been owing to this circumstance.

Exercise of parts during disease does not prevent muscles from wasting; for patients with spinal curvatures have been subject to a wasting and paralysis of muscles, who have persevered in exercise as long as they were able, as was the case of H. Peckman, Miss Ward, &c. And, after constitutional disease has been cured, the patients' muscles do recover their power of exercise, their plumpness and activity, whilst they have continued the horizontal posture.

As far as physiologists trace the rudiments of the fœtus with precision, they discover the different varieties of structure existing at an early period of growth; — that Nature has given to every variety of structure a principle or power, or organs of formation peculiar to itself, which continue to form and maintain the same structure from the cradle to the grave, unless their action be changed by disease; and that organs or vessels, forming or secreting bone, cannot depart from the creative law established by Nature, and secrete cellular texture; unless their primitive power be changed or destroyed by disease, which is allowed to alter all our textures; and which, it is fair to infer, has most probably done so in all the cases where the natural structure of muscles, bones, ligaments, &c., have been reduced to cellular texture. I cannot, therefore, yield to any apprehensions of injurious structural changes of bone and muscle, from observing the recumbent posture in such

cases of spinal curvature as require it, more than would be justified in scrofulous disease of the hip or knee-joints.

Some adults, who have become thin from spinal curvature, have expected their muscles to be much enlarged by exercises, and have been disappointed: as exercise was found to increase their strength only, and bring their size up to the standard Nature intended, and no farther. Their expectations probably arose from this circumstance:—During the growth of the parts of the body, repeated and long-continued exercises of particular muscles give them an extraordinary large development, as is observable in the arms of sailors and black-smiths or anchor-smiths, and in the legs of chairmen; but if an adult, after the completion of his growth, adopt the same exercises, the same muscular enlargement does not ensue.

The length of time required for the cure of the varieties of lateral curvature varies with their causes. When it has originated from carrying a child on one side or from bad habitual postures of the body, the incipient disease will be remedied in a few months, and the patient should be particularly cautioned to avoid the remote causes, and to strengthen the system by every means. If it arise from unequal length of the lower extremities, and be incipient, it will be remedied in a few months, provided the patient abstains from walking about. If he continues to employ the erect attitude as usual, without any mechanical apparatus to counteract the disproportion, the time is indefinite, and the curvature will most probably increase.

If a cuneiform shape of the vertebræ be induced in a rickety habit, and the ribs project backwards, accompanied with a tortuosity of the spine, one year at least will be necessary; and it will be found that the costal distortion will be the last remaining deformity to remove. If the disease be connected with scrofula, the duration and end are uncertain.

When the curvature is ambilateral and of the shape of the Greek sigma, there is no chance of restoring the vertebral column to its spinal line, without the most rigid and persevering observance of all the mechanical and medical means, and even then, the degree of benefit to be derived is uncertain, and the time of obtaining it indefinite; but a degree of good equivalent to the confinement will be insured, if the means be employed during the growth of the body, an observation that leads me to an important topic of enquiry, how far curvatures are remediable, after the growth of the body has terminated. Of late, spinal curvatures have received some considerable elucidations from the spirit of medical investigation that characterizes this period, and have been made more the subject of discussion and of conversation. This has induced many adults to apply for opinions on cases of very long duration.

The view I have taken of the subject is the following:—During the growth of the body, parts of the bony structure that are deficient may be supplied, and those that are redundant and disproportionate may be absorbed, and the equality of size and propor-

tion be restored. After the growth of the body has been completed, and the curvatures are attended with unequal proportions of the thickness of the sides of the vertebræ, and of the length of the ribs and extremities; it is clear that those alterations and additions of structure, necessary to restore symmetry of form, cannot be accomplished, without the creation of a new and successive growth of the diminutive bones or portions of bone; and, as the power of such a new creation is an attribute of the Deity, who has ended his work, and does not belong to man, it is impossible to remedy the finished deformity, or materially change it; yet, there are those who impiously promise and audaciously and ignorantly attempt this new creation, and who rob their fellow creatures of their liberty and time, by consigning them to a long and useless confinement, a motionless rest, and the stretching of machinery, in vain, to counteract the ordinations of Providence, that has given all things their bounds, and has said, "thus far can ye go and no farther."

During the growth of the body, all beneficial changes may be attempted; for nature delights in perfecting her works and will assist us; but when the shape is formed, the bones are consolidated, and the soft parts and viscera are adapted and proportioned to them, and the growth is matured, our endeavours to create anew and remedy old malformations will be nugatory. But a new arrangement of some parts of the structure that are fully organized is a different thing from a new creation, and those that are moveable and elastic, as the ribs, may possibly be modelled anew by long perseverance in appropriate exercises and mechanical contrivances and power, if their proximity to the vertebræ or any other form of distortion, that compresses the lungs and greatly impedes respiration, should render the attempt absolutely requisite and worth the sacrifice.^a

^a [Looking upon contracted muscles as a cause or sustainer of lateral curvature, M. Guérin recommends and practices *subcutaneous* section of such muscles of the back as appear by their tension or contraction to be in fault. The operation is performed as in club-foot and torticollis; and experience, according to Guérin has shown, that extensive sections thus made produce little inconvenience, and are devoid of danger. Care should be previously taken to ascertain whether the set of bones has not become rigid through ankylosis, or hopelessly changed in shape; as in either case an operation is inadmissible. My able colleague, Professor Mütter, tells me that this operation is not held in much regard by European surgeons, and that it is falling into disuse. — Ed.]

CHAPTER IX.

ANGULAR PROJECTION OF THE SPINE.

SECT. I. — *History and Symptoms of Angular Projection.*

THE peculiar form of this species of spinal distortion has been defined at p. 16. This species almost always invades the lower portion of the spinal column, and the principal seat of the malady and projection is in the lumbar vertebræ, the spinous process of the 3d or 4th of which generally forms the prominent angular point. I have, however, seen this form in the centre of the dorsal vertebræ. The reason why this distortion assumes the angular, instead of the curved figure, seems to be, because the lumbar vertebræ below are naturally incapable of so much flexion or of being bowed out so much as the upper vertebræ, or they offer an effectual resistance to it, from being so near a fixed point as the sacrum; hence, the vertebræ below the one disordered or deranged nearly retain their spinal line, whilst those above are removed from it.

Since my attention has been particularly directed to this species of spinal distortion, it has occurred in my practice as frequently as excursions or lateral curvatures.

This distortion generally occurs in young persons from three years of age to twelve; but adults are sometimes obnoxious to it. The projection is formed in a very gradual manner; the spinous process of the 3d or 4th lumbar vertebra is first observed to protrude a little, or both may protrude when first noticed; and as this projection increases and enlarges, it bears out from the spinal line, and elevates five or six of the spinous processes of the vertebræ above it, so that when the projection has made considerable progress, the lower spinous process projects beyond the spinal line from half an inch to nearly an inch, whilst five or six above are gradually inclined outwards from one of the dorsal vertebræ in its natural situation, to the extreme point of angular projection, between which and the lumbar vertebra, *in situ*, below it, there is a space in which the fore-finger may be pressed.

The transverse processes of the same vertebra generally project on each side of the spinous processes, and elevate and stretch the muscles and integuments, so as to produce a bow or arch from side to side, which is supported in the middle by the spinous process. The sternum sometimes projects a little, as in excursion. In the majority of cases, the muscular powers of the back and of the lower extremities are gradually weakened; but in some cases no loss of power is evident. The patients in general become debilitated and soon fatigued from exercise, so that they cannot walk long without seeking a resting place to sit or lie down; when

the projection is half an inch or more, the patient's body is commonly inclined forwards, the act of walking is imperfectly performed in a waddling gait, or the legs cross, and the patient falls down, or the dorsal muscles suddenly lose their power, and the patient stoops forward and seeks support by placing both hands above the knees. At all times, it is customary for the patients to avail themselves of any accidental support that falls in their route. In some cases, there is considerable pain experienced in the deranged vertebræ, and, in others, but very little or none, unless they are much pressed upon, and sometimes pain is not produced by pressure. The pains are sometimes sudden and severe, and compel the patients to throw themselves into the recumbent posture, wherever they happen to be when they supervene. Quick and sudden motions of the spine sometimes induce smart pains in the affected vertebræ. Pains of the back and of one or both knees, in some cases, disturb and prevent sleep, and compel the little patients to scream aloud. These pains generally occur in the night time, and are often connected with, if not caused by, lumbar inflammation and abscess.

Many cases of lumbar abscess are accompanied with a slight angular projection of the lumbar and lower dorsal vertebræ; in some of these there is no evidence, on dissection, of diseased vertebræ, and, probably, the projection in such is caused by the purulent discharge maintained, producing some absorption of the vertebræ or intervertebral cartilage that diminishes their thickness anteriorly. In other cases, the ulceration from lumbar abscess extends to the ligaments, bones and cartilages of the lumbar vertebræ, and thus produces the angular projection. The effects of spinal distortion and disease, in this species, sometimes extend to the organs above its seat, and headache is induced frequently, and, on slight exertions, dyspnœa is experienced. Dyspnœa and cough are very distressing, if the middle dorsal vertebræ be the seat of distortion. The appetite is sometimes impaired and dyspepsia complained of; but the digestive organs do not, in general, suffer much derangement. Some patients become emaciated, but the greater number retain a good share of general health and preserve their *embonpoint*. In a few instances, when the distortion prevails in a scrofulous habit, and is connected with scrofulous destruction or inflammation of the bodies of the vertebræ or of one of the intervertebral substances, the general health is involved and the symptoms are very severe. In such, the patient's case has been commonly neglected; the pains have increased, until they become severe on the slightest motion or pressure, or when the erect attitude exposes the diseased vertebræ to superincumbent weight: the inability to walk about, and the pain on sitting up, gradually increase, until the patient is constrained to observe the recumbent posture and cannot bear to be placed upright, and when the vertebræ, intervertebral substance and ligaments are much diseased, the patients instinctively seek to take off all weight and

pressure from the bodies of the vertebræ, by lying down in the facial horizontal position, or by placing themselves on their knees and elbows, and in this position seeking that ease and sleep which they cannot obtain in any other. In these positions, the lumbar portions of the spine sink inwards, by which the horizontal surfaces of the vertebræ are as much separated as possible by position, and pressure is removed. In the meantime, pus collects between the 2d and 3d, or the 3d and 4th, or the 4th and 5th, lumbar vertebræ, and at length opens through a small orifice of the anterior spinal ligament, either on the anterior or lateral portions of the vertebral joint, and pours forth its matter into the cellular tissue covering the spine, which becomes a lumbar abscess on one side; but in the process of time the orifice enlarges by ulceration, until the ligaments are destroyed all round the bodies of the two vertebræ, and the pus, issuing on both sides of the vertebræ, forms a lumbar abscess on each side, the matter of which gradually insinuates itself along the *psoæ* muscles, or the course of the external iliac artery under Poupart's ligament, and points at the top of the thigh, or it takes the direction of the hypogastric vessels and opens at the verge of the anus. The accumulations of matter behind the peritoneum frequently inflame that membrane, and sometimes break through it into the abdominal cavity. Sometimes, serofulous ulcerations of other joints or parts precede that of the lumbar vertebræ, or are occasionally induced with it, or follow it. The pus discharged is sometimes laudable, is sometimes mixed with serofulous coagula, and at other times is fetid and dark. With these local affections arise symptoms of hectic fever, debility and emaciation, which finally reduce the patient to skin and bone. The appetite is sometimes preserved in a tolerable degree, even within a few days of dissolution.

Sleep is disturbed and with difficulty induced even when in the postures above described, and aided by opium. Diarrhœa arises, which soon exhausts the strength, or death approaches more gradually, and the patient insensibly and almost imperceptibly sinks into the grave. When the peritoneum inflames, there is a sudden accession of pain in the lumbar region, attended with fever; and if the pus breaks through it into the abdominal cavity, the most distressing pains; jactitation; restlessness; fever; thirst, and quick, small pulse ensue, that soon closes the afflicting scene. It may be observed, that severe pain of the head, similar to that in phrenitis, sometimes occurs for some days before dissolution, and becomes the most prominent and painful symptom.

In this, as in the other forms of spinal distortion, its progress is rapidly increased by the induction of fever or any of the exanthemata; and if the patient have been in a state of progressive amendment, the spine relapses into an angular projection nearly as great as ever, but I have not seen this event followed by any fatal consequences.

SECT. II. — *Appearances on Dissection.*

Dissection generally discloses disease of bone, intervertebral cartilage and ligament. The intervertebral substance of one joint, and sometimes of two, is commonly destroyed so completely, that not a vestige of them remains; in such cases, the horizontal surfaces of the vertebræ are more or less destroyed by caries, both above and below, and the anterior spinal ligament and ligamenta intervertebralia are often destroyed in the whole space opposite to the hiatus, made by the destruction of the intervertebral substance and the horizontal surfaces of the bodies of the vertebræ; in some cases, bands of the anterior spinal ligament remain, but they are very much thickened, are more vascular, and sometimes present parts of a semilivid appearance. The horizontal surfaces of the vertebræ are sometimes absorbed on one side more than the other, which occasion a lateral inclination of the body to be combined with the angular projection; and, on this side, the lumbar abscess generally collects. Whilst the intervertebral substance and the horizontal surfaces to which they are connected are in a state of progressive destruction, caries sometimes attacks the cancellous structure of one or two other vertebræ on their surface, which implants inflammation in, and occasions thickening of, that part of the anterior spinal ligament attached to, or opposite, the carious surface. When two or three intervertebral substances are destroyed, the body of one vertebra is sometimes broken across its long diameter and would fall out, if not prevented by the attachment of some remaining bands of ligament to its anterior surface, or the resistance made by the soft parts and peritoneum, anterior to their position. The pus, bone, and intervertebral substance (if any remain), present two different appearances. In one instance, the pus is white and laudable, and the bones are also white, as well as the intervertebral substance. In this case, the bones are porous and soft. In the other, the pus is dark and fetid, resembling dark blue mud, and the bones are nearly black, but not so porous and soft, and the intervertebral substance, if any, is dark, like the carious bone: to the latter diseased appearances, I have sometimes applied the term gangrenous in this Essay, for want of a word that would be more explanatory of their condition and the idea I wish to convey. The pus is sometimes mixed with serofulous coagula, but is frequently not. It is almost superfluous to add, that dissection lays open collections of matter proceeding from the vertebral joints, which are situated on the sides of the vertebræ, or can be traced along the course of the flexor muscles of the thigh (sometimes affecting their texture) to their external opening in the groin; to the verge of the anus; or to the sides of the spinous processes in the loins. The portion of peritoneum covering the abscess is sometimes extensively inflamed, and at other times only exhibits patches of inflammation.

The spinal canal, in angular projection, frequently maintains its continuity; but when the intervertebral substance between the carious vertebræ has been entirely destroyed, and the bodies of one or more vertebræ have been diminished by ulcerative absorption on their posterior surfaces, the integrity of the canal is lost at those parts; the posterior spinal ligament is sometimes destroyed; and the membranes of the medulla spinalis become exposed to the contact of pus, and exhibit evident traces of previous local inflammation, the membranes being redder, and the blood-vessels appearing more injected and numerous than natural.

These circumstances and morbid appearances occur also in excurvation of the spine, when the bodies of the vertebræ and intervertebral substance have been entirely destroyed by ulcerative absorption, but they were not so particularly noticed in describing the effects of that form of curvature.

Dissection also shows a state of parts very different from the above. The whole of the vertebræ, intervertebral cartilages and ligaments shall be perfectly healthy, but an unequal or disproportionate growth of bone is evident, by which the spinous and transverse processes are preternaturally enlarged; the transverse and oblique processes of the 3d and 4th, or 4th and 5th vertebræ overlap each other, by which the spinous processes are thrown back and form the angular point. In one instance, the spinal canal and medulla were enlarged in this part. It has been observed, that lumbar abscess and the diseased state of the vertebral joints in this disease, reciprocally produce each other, but do not necessarily do so. When psoas abscess conduces to this projection, the intervertebral substance may be only diminished in thickness anteriorly. In other instances, the pressure of the matter of lumbar abscess may produce absorption, ulceration, and caries of the constituent parts of the spine on one side, that shall extend to the whole of the horizontal surfaces of two or more vertebræ and their intervertebral substance, and occasion angular projection. It may form a lateral excurvation in the body of one vertebræ or in the intervertebral substance, without producing distortion. In Mr. Brookes's museum, there is a specimen of a complete excavation of the body of the second lumbar vertebra by the pressure of the cyst of a psoas abscess on the right side. It may be remarked from this specimen, in illustration of what has been said relative to the mode by which spinal distortions are produced, that the lower horizontal surface of the 2d lumbar vertebra has been destroyed by ulcerative absorption, except at two anterior points, by which, as by pillars, the vertebral column has been supported erect, and the projection prevented. Hence, caries of the lumbar vertebræ, ulceration of the intervertebral substance, and lumbar abscess sometimes exist, without producing curvature or angular projection; and the latter sometimes exist without the induction of those structural derangements.

SECT. III. — *Prognosis and Diagnosis.*

Every case of this disease that has been placed under my care within six months after its formation has been treated with success, unless caused by lumbar abscess already produced.

Cases of long duration, in which the previous symptoms of inflammation had existed, and in which emaciation, great debility, much pain of the back and hectic fever have been induced before due surgical attention has been paid, have terminated fatally.

If the lumbar pain abate, if the prevailing symptoms become mitigated or relieved, and if the general health improve soon after the surgical treatment has been adopted, the prognosis may be favourable. If the contrary effect takes place, and the patient's condition be not soon ameliorated, an unfavourable issue may be expected. The induction of lumbar abscess is unfavourable, because it is a proof of the previous ulceration of the intervertebral substance and ligaments, and of a carious state of some vertebræ. The case is nearly as unfavourable, if the lumbar abscess have been the primitive affection.

The form of the distortion will enable any one to distinguish angular projection from curvature or any other deformity.

SECT. IV. — *Causes of Angular Projection.*

The remote causes of this species of spinal distortion are contusions of the spine; sprains of the lumbar vertebral joints; muscular debility; pressure of the cyst of lumbar abscess; a rickety growth or malformation of the bony bridge; and, more frequently than any other, scrofulous or common inflammation of the intervertebral cartilage, and horizontal surfaces of the vertebral bodies.

The immediate causes, being the same as of other spinal distortions, must be sought for in a structural disproportion between the anterior and posterior portions of the vertebræ or intervertebral cartilages, or in the destruction of the horizontal surfaces of one or more vertebræ, and the intervertebral cartilages situated between them. The connection between the remote and proximate causes, or ultimate effect, has been already traced, in treating of the other forms of spinal distortion, particularly of excurvation. *Chap. III., Sect. II.*

The disproportion between the anterior and posterior parts of the bodies of the vertebræ and intervertebral substance is produced, in one way, by the morbid or rickety enlargement of the posterior part or bony bridge, the mechanical effects of which, in producing pressure and absorption of the horizontal surfaces of the vertebral bodies and cartilage, have been stated at p. 54. This enlargement of the bony bridge in a part of the spine, must elevate the posterior portions of the vertebra above it, and incline them over on their

anterior portion, by which the spinous processes, which naturally lie over each other, in almost a perpendicular direction, like the plaits of a coat of mail, must be projected at an oblique angle, and protrude beyond their spinal line. The excess of growth acts on the principle of a wedge, which, being driven between two divisions of an architectural pyramid, must elevate the parts of the column above, and incline them to the opposite side.

A morbid increase of the bony bridge is not the only way in which angular projection is immediately produced. For the spinous processes most protrude, whenever the thickness of the bodies of one or two vertebræ is so much diminished by absorption, that one vertebra, especially in its long diameter, permanently inclines over its axis or centre, to its anterior half. For, as in their natural situation, most of the spinous processes slope downwards, and are locked together, so must one protrude outwards beyond its spinal line, whenever it is raised by depressing the anterior portion, or opposite end of the oblong bone of which it forms the other extreme part or end, and in proportion to the degree of the elevation of one spinous process, must the spinous processes, and bony bridge above, be raised, and throw the superincumbent weight of the column, &c., on the anterior parts of the bodies of the vertebræ.

Of course, it is here assumed, that the depression of the anterior portions of the vertebræ cannot be accomplished without the thickness having been diminished by progressive or ulcerative absorption.

It appears to me, that when the horizontal surfaces of one or two vertebræ are thus absorbed, the angular projection is produced; but if more vertebræ are implicated, a curvature will eventually ensue.

Should the intervertebral cartilage alone be absorbed between any two of the vertebræ, there would not be a proper mechanical support for the spine in the erect attitude, if the horizontal surfaces of the vertebræ, above and below this space, did not rest upon each other; and, it is clear, that this approximation must be effected by the body of the uppermost vertebra inclining over its centre, to its anterior part, by which the spinous processes must be raised up, and project to an angular point. When the intervertebral substance and anterior parts of the horizontal surfaces of the bodies of the vertebræ are both destroyed, the forward inflection must be proportionably greater, and the spinous processes must protrude to a greater extent posteriorly, and elevate the spinous processes more above, so that the vertebral column above the angular projection inclines forwards, in the direction of a line of an acute angle. The vertebral destruction above-mentioned is generally the consequence of scrofulous or chronic inflammation, followed by ulceration and caries.

An habitual stoop, from contusion or sprain of the spinal joints, may produce angular projection, by occasioning pressure on, and absorption of, the anterior parts of the vertebral column.

When the pus formed in a vertebral joint finds its ways out on the side of the spinal column, or the pressure of a lumbar abscess produces lateral absorption of the vertebræ and intervertebral substance, their anterior portions may be but little destroyed, or may wholly escape: in which case, the angular projection will be small, although the danger, to the patient be equally great, for the remaining anterior portions of the vertebræ will give a mechanical support to the spine, equal to small columns or pillars, and sufficient to keep it erect.

Some may cavil with the name I have given to the species of spinal distortion, the causes and form of which have been explained in this section; but the propriety of adopting an appropriate and characteristic appellation may be more readily assented to, when it is known that the most singular, and perhaps able surgeon of the day, has described this deformity as a curvature somewhat more than a semicircle, — “Her lumbar vertebræ were bent into more than a semicircle.”* Which seems almost impossible; for if the lumbar vertebræ were so bent, the head would be projecting beyond the natural axis of the body its whole length above the curvature, in a horizontal direction, which has not, I apprehend, yet occurred.

SECT. V. — *Treatment of the Angular Projection of the Spine.*

Many of the indications of cure enumerated for the treatment of excurvation of the spine, are, with equal propriety, applicable to the angular projection, and the mode of treatment they inculcate will be found as serviceable.

Successive experience has corroborated the evidence afforded, of this variety of distortion being caused by a disproportionate growth of the parts of the vertebræ constituting the bony bridge; for it frequently occurs, that one or two transverse or spinous processes remain enlarged, after the disproportionate growth of this part of the vertebræ has ceased, and other structural changes have accommodated this disproportion, so that the tendency of such growth, by its wedge-like action, to throw the weight of the spinal column on the anterior portions of the deranged vertebræ, has been obviated, and the remaining enlargement becomes a disfigurement, but by no means occasions any curvature, or interferes with the erect attitude of the body, or impedes the movements of the spine.

Reposing in the facial horizontal position on a soft feather bed, will be found particularly advantageous in this variety, for, as in all the cases I have seen, except one, which involved the central dorsal vertebræ, the most projecting spinous processes were those of the lumbar or lowest dorsal vertebræ, which consequently form the

* Mr. Abernethy on Lumbar Abscesses, Case 5.

seat of distortion or disease; and as, in this position, this part of the spine gravitates and inclines inwards more than in any other, so as to form even in health an artificial incurvation, by which the anterior portions of the spine are separated and the posterior more closely applied, it is easy to infer, that all weight and pressure are taken off the anterior portions of the column, by which the progressive absorption is suspended and further prevented, and that some weight of the column, by the incurvation, is transferred to the posterior portion, where it occasions such a degree of pressure, as may arrest the disproportionate growth of bone, or if not, it may conduce to its accommodation, by the tendency of its pressure to promote absorption of the parts of the vertebra above and below it, by which space will be formed to accommodate the disproportioned and enlarged vertebra, and the balance of the spinal line preserved. The truth of the inference as to the value of position, also admits of something like negative proof, for when corpulency prevents the lumbar portion of the spine from making the inward bend in the facial horizontal position, this particular form of projection is a long time before it is remedied, and the only case that has proved especially tedious, is that of S. Sullivan, 72 Crawford Street, Montague Square, — whose abdomen was protuberant and large, and protruded the spine somewhat outwards when laid upon it.

The facial horizontal position, by producing rest of the spinal joints, and by taking off all pressure from the intervertebral substance, conduces to allay the irritation excited by the superincumbent weight, and the motion of the joints, when this substance is inflamed, and becomes a very powerful means of preventing an increase of inflammation, as well as of abating that which exists, and of obtaining its resolution.

As dissections prove that the most dangerous and fatal consequences ensue from inflammation of the intervertebral substance, terminating in its ulceration, which brings in its train, caries of the surfaces of the vertebræ to which it is attached, and ulceration of the anterior spinal and capsular ligaments, with many unpleasant symptoms; whenever symptoms of its inflammation occur, or pain is felt on pressure, or on motion, the remedial measures should be directed to remove it. Topical bleeding, repeated as often as necessary, by cupping or leeches; blisters; a daily hydragogue aperient, with alteratives; a low regimen, and perfect rest, should be prescribed.

Mr. Copeland and Mr. Brodie* have both advanced an opinion, that issues or setons are peculiarly beneficial in, and adapted to, the cases originating in intervertebral inflammation, which has always a strong tendency to ulceration, if not powerfully counteracted; this opinion accords with my experience, and as I am induced to believe, from the appearances on dissection, that the inflammation primarily attacks the intervertebral substance, in the

* Copeland on the Spine, p. 42. Brodie on the Joints, p. 180.

generality of cases of angular projection, not arising from unequal growth of bone ; issues, setons, or perpetual blisters, should be recommended and used, if the parents or patients will consent. In confirmation of the utility of artificial local ulcerations on the skin, it may be observed that I have witnessed a successful issue in two cases where ulceration has been accidentally induced by the pressure of the compress and shield ; in one, from pustular eruptions, arising in the vicinity of the projecting spinous processes ; and, in one, where the eruption of small-pox supervened, and cured the patient.*

When there is reason to suspect a scrofulous diathesis, from a history of the family, or from scrofulous affections being present in other parts of the body, a preventive plan of alteratives, and other medicines suited to the case, should be adopted ; but, above all, the effects of inflammation should be watched, and counteracted by the means already enumerated.

If a judicious medical and mechanical treatment be resorted to in the early stage of angular projection, it seldom occurs that any great constitutional derangement supervenes ; if it does, the remedies already mentioned, as well as those recommended for particular symptoms in excurvation, should be employed. Constipation should in all cases be obviated, and the digestive functions regulated, and preserved in health, by appropriate medicines and regimen. Should there be evident weakness of the dorsal muscles, without marks of inflammation, chalybeates and cold bath, local or general, have produced a decided good effect, used with an occasional laxative of rhubarb.

Should the endeavours fail to produce resolution of the inflammatory condition of the affected portion of the spine and suppuration, caries and abscess ensue ; whilst the counter-irritants are continued, the strength should be supported by tonics, and a generous and nutritive diet, and pain should be allayed, and sleep produced by opium, or other narcotics, so that the constitution may be assisted in arresting the fatal tendency of this state of disease.

Pressure, extension of the spine, friction with stimulating liniments, &c., when issues are not established, are advantageously employed, as in the other varieties, as well as the use of the apparatus of bandage, compress, and shield.

The bandage should be broad, and so applied that some of its turns reach high up on the ribs, and down on the pelvis, from which the patient experiences much relief and comfort. It need hardly be repeated, that pressure and extension should not be employed during the inflammatory or ulcerative stages of this form of disease, or of any species of curvature, when they produce irritation or pain ; nor should they be used when it is supposed that an anchylosis, or deposits of osseous matter are forming.

After the mechanical and medical means have been attentively

* See Mary Howell's Case.

employed about three months, if the patient be directed to assume the erect attitude, and the spine be examined, it will generally be perceived that the lumbar portion of the spinal line is inclined forwards; when this effect is produced, and towards the end of the cure generally, lying on the back, and the frequent exercise of the lower limbs in flexion and extension, will prove advantageous, as it will tend to bring the spinal line into the natural axis of the body, and the forcible extension of the flexor muscles of the thigh will draw in the lumbar vertebræ. In the most favourable cases, there remains an apparent projection of about one-fourth of an inch of one or two spinous processes, or of one or two transverse processes, which protrude a little beyond the level of the spinous processes, but this does not alter the natural axis of the body, nor prevent the patient from standing upright, and preserving the erect attitude, and is a mark of some disproportion of growth still remaining.

In some cases, where the spine instrument has been subsequently worn, after exercise is resumed, the projection of the spinous processes gradually recedes in succession; first the lower one resumes its natural situation, and subsequently all those above it, until the spine be straight. If this variety of curvature be neglected, so that no surgical means have been employed to arrest its progress, the angular point will be rounded a little, so as to appear like an irregular excurvation of the spine, by the vertebræ below that forming the angular projection being bent a little backwards.

Although it has been stated that three months are sufficient to restore the erect attitude, yet the time required for remedying the disproportion of growth, or of preventing or obviating the bad effects of it, is generally indefinite; so that the horizontal position should be persevered in for many months, in some cases, even after the patient can walk upright; for it has occasionally happened that the disposition to disproportionate growth has returned, or it has appeared the disproportion had not been well accommodated, and the patient again becomes inclined to stoop forward, and throw out the spinous processes. In this case, the patient should resume the facial horizontal position for two or three months, or even longer, and after he has begun to employ the exercise of walking, &c., he should divide his time between exercise and horizontal rest, until every morbid predisposition be subdued.

To prevent stooping when employing exercise, the patient should wear the spine instrument, and in the cases (and they are many) in which the patients cannot be induced to resume the recumbent posture, or the parents of children do not enforce its use, this machine or instrument of a like construction should be worn a considerable length of time, to assist in retaining the body upright, but constructed on a plan not to grasp the pelvis so tight as to produce injurious pressure. — *See the collar described at p. 155.*

The projection of the lowest protruding spinous process in this variety is always sharp, and as it were pointed, so that if opposed to any thing hard external to the skin, its pressure sometimes pro-

duces superficial ulceration of the skin, and occasionally a slough, which, on separation, leaves an ulcerated opening, through which the spinous process protrudes. In the former case, some simple dressing should be applied under the compress once or twice a day, until it heals. In the latter case, it seems preferable not to apply any dressings, but to allow Nature to form her own crusts, under which she will advantageously employ those curative processes by which the injury will be repaired. In these cases, the use of the bandage and other apparatus must be discontinued, and a guard placed over the back to protect the ulcer from the contact of the bed-clothes, whilst the patient strictly observes the facial horizontal position.* When scrofulous inflammation is present, the time of recovery or of death must be uncertain.

Death generally gains his victory in two or three years; whilst a recovery is much more frequently ensured in a year.

Case. — Miss Jane Weatherhead, aged five years, six months, 98, East street, Manchester Square, June 10th, 1823. About three years and a half ago, she was seized with inflammation about the left elbow joint, and a swelling which extended to the wrist; an abscess was formed, communicating with the joint, that continued to discharge until her death. Six months after, the right ankle joint began to inflame and swell; in two months an abscess opened, communicating with the joint, the bones of which became carious and continued so at her death. About eighteen months since, the right wrist began to swell and inflame, and in four months another abscess formed which never closed. The mother soon after perceived her child to walk with an inclination of the body to the right side, and she complained of a pain in her back, but the ulcerated state of the ankle prevented her from distinguishing whether lameness were owing to the condition of the back or ankle. She at length, about a year since, observed the projection in the loins, which gradually increased. Last June, the child mentioned a tumour in the right groin, which soon after broke and discharged much matter; about this time I was requested to attend her, and found all the abscesses I have mentioned discharging a thin pus, the patient much emaciated and helpless; she was unable to sit upright, and hectic fever regularly supervened. She slept in a position resting on her knees and fore-arms, with her forehead on a pillow between her hands, as she found it the easiest, and instinctively sought it. There was an angular projection of one lumbar and three dorsal vertebræ, and the spinous process of the 4th lumbar vertebra formed the angular point. I apprized the parents of the extent of the disease, and of the case being hopeless. The pain of the back excited loud screaming. Her health had been bad from the first, but after June she rapidly declined; her extremities became paralytic, but she was always able to retain her urine and fæces. She was sensible to the last,

* Frances Parker's Case.

and died from exhaustion, October 27th. — Tonics and opium were freely given, and she drank much porter.

Dissection. — The abdominal and thoracic viscera were sound, except that the peritoneum was inflamed, red, and vascular, opposite the diseased vertebræ, and the collections of pus around them. The intervertebral cartilages between the 2d and 3d, and 3d and 4th lumbar vertebræ were entirely destroyed, and in a great degree between the 4th and 5th; the horizontal surfaces of the 2d, 3d, 4th, and 5th lumbar vertebræ were partly destroyed by caries; the body of the 3d lumbar vertebra was broken across its long diameter, and was loose, but partly retained in its proper situation by the attachment of a remaining portion of the spinal ligament; the bones were white and spongy, and were enveloped in a white pus. The intervertebral substances between the 2d and 3d, and 3d and 4th lumbar vertebræ were destroyed by ulceration. Between the 4th and 5th, there was only a small opening in the anterior spinal ligament for the exit of pus from the joint.

The anterior spinal ligament opposite the diseased bones was entirely separated from them on the sides, and much destroyed by ulceration; it adhered to the anterior portion of the 3d or fractured vertebra, about one inch above, and there was only a band of it half an inch broad, continued down to the 4th vertebra, but which was sufficient to prevent the fractured bone from falling out. The posterior spinal ligament was ulcerated, but the theca vertebralis was not; it, however, exhibited numerous blood-vessels and had been inflamed.

Case. — Charles Wainsbury, aged five years, nine months, No. 11 Charlton street, Fitzroy Square, after small-pox, about two years ago, fell into general bad health and impaired appetite, and gradually decreased in flesh and strength; the first deviation of position observed in the spine, was a bending backwards, and the abdomen appeared tumid and protruding. He never complained of any pain of the back till within the last eight months, at which time he was observed to lean to the right side, and to be unable to keep the body erect.

About two months since, his parents applied to the Royal Metropolitan Infirmary for sick children; when a projection of the spinous process of the 3d lumbar vertebra to an angular point was evident, by which the spinous processes of the lumbar and three dorsal vertebræ above were elevated, and formed an inclined line of projection. The pain in the back is severe, especially at night, and in the erect posture; the patient is much emaciated, affected with hectic fever, and gradually sinking. There is a discharge of pus on the verge of the anus, which is supposed to proceed from a lumbar abscess. Some days before the patient's decease, on November 7th, he was affected with such severe pains of the head as to render the application of leeches advisable. Paralysis was not induced in this case.

Dissection. — The viscera were sound. The intervertebral sub-

stance between the 3d and 4th lumbar vertebræ was entirely destroyed by ulceration, and the horizontal surfaces of the vertebræ to which it had been attached, were black and carious, and partly absorbed. The discharge from the carious and ulcerated parts was like dark blue mud, and fetid. The anterior spinal and intervertebral ligaments were destroyed all round as far as the progressive ulceration of bone and cartilage had extended, and the edges of the anterior spinal ligament, above and below the caries, were thickened, dark, and ulcerated. The body of the 2d lumbar vertebra, on its anterior part, was black, and soft as carious bone, and the ligament covering it was thickened, dark and vascular. The discharge poured out from the space between the 3d and 4th lumbar vertebræ, had insinuated itself along the right psoæ muscles and hypogastric vessels, and formed an opening on the verge of the anus. The parts along which the discharge had passed were soft and ulcerated. The bodies of the vertebræ had been more absorbed on the right than the left side, which accounts for a lateral inclination being given to the forward stoop. The theca vertebralis and medulla spinalis were not diseased.

For an acquaintance with this case, I am particularly indebted to my excellent colleague and friend; Mr. A. C. Hutchison, who possesses much practical experience in spinal diseases.

In discussing of the utility of the collar or spine instrument and other machines in spinal distortions, an endeavour was made to obviate all objections to the use of the collar, except such as arose from their unnecessary weight, and from the risk that might be incurred from repressing the growth of the upper part of the pelvis, if the lower hoop of the instrument, adapted to the size of a patient of the age of five, for instance, continued to be worn until he was seven years old, and proportionably larger, or if it were constantly worn during the successive enlargements and constant alterations of proportion made by the growth of the body. I feel much pleasure in communicating, that Mr. S. Moginie, 1, Princes Row, Pimlico, manufactures collars or spine instruments free from those, and, in my opinion, all other objections, in such cases as it is proper to employ them. The following description of the instrument may convey some comprehensible idea of its construction and uses. It consists of an upright or spinal bar, that is placed in the direction of the spine; of a straight bar that crosses the scapulæ, and may be called the scapular bar; of axillary supports; and of a pelvic hoop that embraces the pelvis and rests on the spine of the ilium. The whole are of steel. The upright or spinal bar has an open groove along its middle, and eight screw-holes at the top and bottom. A moveable soft pad, to be opposed to the outward curvature or angular projection of the spine, traverses in the groove, and may be fixed opposite to any part of the spine by means of a thumb-screw and nuts on each side of the bar. The screw-holes at the top and bottom are at a small perpendicular distance from each other, and are for the purpose of screwing on the scapular

bar, and the back piece of the pelvic hoop below, at a distance most suited to the height of the patient, and can be accommodated to any after-growth. The pelvic hoop consists of three pieces: a back piece and two moveable lateral ones. The back piece screws on the lower part of the spinal bar, and has an open groove, three inches long on each side; the lateral pieces have corresponding grooves of the same length, and are fixed to the back piece by means of thumb-screws and nuts. The lateral pieces traverse, and can, of course, be let out the whole length of their grooves, and can be fixed to any part of their length, by turning the thumb-screws that pass through the grooves of both pieces. The lateral pieces are shaped anteriorly, so as to seize the spine of the ilium, and are partly covered with leather, to which a strap and buckle are attached, for the purpose of buckling the hoop across the pubis. The scapular bar fastens to the spinal bar, by a thumb-screw, and has four or six screw-holes at each end, to which the axillary supports are screwed. The axillary supports and contrivance for bracing the shoulders back, being fixed by thumb-screws to the scapular bar, form a square of small steel bars.

On the lower bar is fastened a cushion for the axilla to rest on; on the anterior bar is a cushion to press against the fore part of the shoulder; the anterior bar slides off and on the upper and lower bars, and when taken off, the upper bar lifts up, and allows the shoulder to be put into the square; the anterior bar has straps above and below, with button-holes that fasten to knobs on the posterior bar, by which it is made to fit close, and, by its pad, to press the shoulder back. The axillary supports prevent the body from bending laterally. To this machine may be added the curved or forked rod, to support the head, or the mechanical contrivance to keep the head erect, which forms a part of the next instrument to be described.

The superior advantages of this spine instrument are the following. It is so light that it only weighs a little more than two pounds. The whole is made of tempered and elastic steel, which allows of some degree of action of the muscles of the spine and trunk. The axillæ and shoulders are protected from being cut and chafed, as they usually are, by the shoulder straps of other collars, and no pressure is made by any part of it except the pad. By the open sliding grooves and screw-holes, it can be accommodated to all sizes and changes of growth, or any alteration of bulk that may take place during the cure.

It would be difficult to improve upon this instrument, which is the joint invention of Mr. E. Jukes, and Mr. Moginie. Axillary supports, however, made of steel, might be constructed, of the form of the shoulders, without pressing against the edges of the arm-pits.

Mr. Moginie has also constructed a back board, to which is fitted a very ingenious contrivance to keep the head and spine erect. It consists of a common back board; the scapular bar and

axillary supports already described; of a box spring, pulley and cord, and a head-piece, or band.

The scapular bar is screwed to the back board. The head piece is made of a padded elastic spring, covered with leather, which grasps the head in a line with the forehead, around which a strap is passed from one side, that is buckled to the other, and secures it. The box spring is secured to the bottom of the back board, and is of the same materials, and made on the same principle, as a watch spring.

From the spring a silk cord is led through two pulleys, to be hooked to the head-piece. The spring can be adjusted to any required power, as by winding it up it can be increased, and *vice versa*.

When the head is erect, the cord does not draw it back. But as the head is bent forwards, the spring resists more and more, as every inch of the cord is extended, until it arrives at a given extent, beyond which the spring will not yield, and then the tight cord occasions the head to be pulled backwards so forcibly, that the patient is soon weary and raises the head erect. This bending and raising the head and upper part of the spine may be performed as an exercise. The whole of this instrument and the last may be concealed, except the head-piece, and this may be covered with vellum, or a riband, so as to appear like a lady's fillet; and, in a young lady, would be regarded as an ornamental part of her head-dress.*

It might naturally be expected that a practical Essay on Spinal Diseases, should embrace the subject of lumbar abscess, but it did not form a part of the original plan of the author, and as there is already a standard work on this disease, he has contented himself with occasional allusions to it, and such suggestions of improvements in its treatment as experience has given rise to. In the treatment of diseases about the loins, every exertion should be made to prevent inflammation of the bodies, cartilages, and ligaments of the vertebræ, and the cellular texture about them, from terminating in suppuration. The resulting lumbar abscess should be opened, with caution, when necessary, and every effort should be made to prevent the permanent contraction of the flexor muscles of the thigh, and the afflicting lameness and deformity it entails.

* [I may here repeat, that the axilla being a moveable point affords no good means of support, and that there are many objections to the throwing the weight of the head and shoulders on the pelvis. A spine car is not liable to such disqualifications.—ED.]

CHAPTER X.

FRACTURES AND DISLOCATIONS OF THE VERTEBRÆ.

SECT. I. — *Dislocations of the Vertebrae.*

As dislocations of the vertebræ occur so rarely, unless they are combined with fracture, it has not been thought expedient to assign a distinct chapter to them. Dislocations of the vertebræ may be partial or complete; that is, it may be a luxation and complete, or a subluxation and incomplete.

Instances of dislocation of the first cervical vertebra from the second have been recorded by Desault, and by Dr. Settin, in which reduction was accomplished, and the patients recovered; others are recorded by Petit, Dr. Howison,* Mr. Charles Bell,† &c., in which the patients perished. In this dislocation, the atlas and head fall forward, whilst the processus dentatus projects backwards, and compresses the medulla spinalis, from which alarming symptoms arise, if death be not instantaneous.

The symptoms are those of insensibility and paralysis. The luxation is generally occasioned by a violent force, that both extends the spine and twists the neck to one side, or the atlas is luxated in consequence of progressive ulceration, gradually destroying the processus dentatus of the 2d cervical vertebræ, or of disease and sudden rupture of the transverse ligament.

The attempt at reduction has been made in the following manner, when the luxation has been the effect of violence; incline the head a little on that side to which it is directed, to disengage the articulating process of the upper vertebræ, fix the shoulders, raise the head gently, and gradually turn it into its natural situation, by a rotatory motion contrary to that which has dislocated it. The operation is dangerous, as, by increasing the compression on the spinal marrow, in inclining the head to the side towards which it is directed, the patient may perish in the operation. The reduction of the dislocation from violence, of the head from the atlas, or of the 1st cervical vertebra from the 2d, must be speedily performed, or death ensues, if, indeed, it be not instantaneous.

It is observed, in the elementary works on surgery, that there is no instance of the atlas being luxated from the os occipitis, in consequence of their firm ligamentous connexion. In the *Edinburgh Journal*, for April, 1813, "a remarkable case of the dislocation of the atlas" is, however, detailed by Mr. now Dr. Lazaretto. James Jackson, æt. 32, was struck with the lower studding-sail yard, on the back of the neck, which drove his head against some spars. He was instantly brought to Mr. L., who, on examination, dis-

* *Edinburgh Journal*, for 1819.† *Hospital Reports*, loc. cit.

covered the atlas was displaced from the foramen magnum; he was senseless, with laborious respiration; rattling in the throat; cold extremities; dilated pupils; slow, interrupted pulse; paralysis of the lower extremities, and bleeding from the mouth and nose.

The dislocation was reduced, twenty ounces of blood were drawn, and gave great relief. A purge of calomel gr. x. and p. jal. gr. xv. was given. On the following day, the patient was sensible, but his speech was inarticulate; the pulse was feeble, and irregularly intermitting, and he complained much of pain in the back part of his head.

The purgative had not acted, and, in the course of the day, he vomited blood, which was stopt by diluted sulphuric acid. A clyster relieved the bowels. The patient was gradually recovering from the paralysis, when Mr. L. last saw him at the Hospital, and he was able to walk with the assistance of crutches. Mr. L. does not state by what mode he reduced the dislocation.

Mons. Bertin, in his description of the Royal Museum, tom. iii., p. 99, states that he has seen several specimens, which have induced him to suspect that the 1st cervical vertebra had been completely dislocated, even without death having ensued, and in such cases, anchylosis of the atlas to the occipital bone has taken place. Mons. Ollivier has quoted several authors, who have related remarkable cases of the luxation or subluxation of the two 1st cervical vertebræ, which have been gradually induced from diseased causes, or errors of growth, in which compression of the spinal marrow has been so slowly induced, as not to occasion death.

Anchylosis has also ensued in some of those cases, of which Duverney has recorded a singular instance. *Ollivier de la Moelle Epiniere*, p. 201, *et seq.* Riest and others, relate cases of recovery, after luxation of those vertebræ, which have arisen from internal causes, but, of this fact, there is no very convincing evidence. In these cases, it is inferred, that the low and gradual induction of the compression has enabled the spinal marrow to accommodate itself to its endurance.

Partial dislocation of the 3d, 4th, 5th, and 6th cervical vertebræ is said to be reduced, without producing death. Sir E. Home* and Mons. Ollivier relate a case each, of the dislocation of the 6th from the 7th cervical vertebræ, without fracture, which terminated fatally.

In such cases of subluxation, only one articular process is luxated, and the spinal channel is not so much diminished by the altered position of the vertebra, as to compress the medulla spinalis with power adequate to occasion paralysis and death. Cases of partial dislocation or subluxation of the dorsal and lumbar vertebræ are recorded by Messrs. Bond, Dorr, Sir A. Cooper, and C. Bell. Subluxation is most commonly produced, in young persons, by a heavy weight falling, or being placed, on the head and shoul-

* Philosophical Transactions, May, 1814.

ders, which suddenly overbalances the body, and bends or curves the spine to its utmost extent, whilst it gives a rotatory motion, by which the articulating processes are more or less separated from their connexions; if they return again to their places, the case is diastasis; but sometimes their edges meet, then it is subluxation, and they are not restored to their natural position. — *Mr. C. Bell, p. 10-11, on Injuries of the Spine, &c.*

In subluxation, the injured portion of spine presents a distorted appearance, similar to that of the angular projection; for the spinous processes project beyond the spinal line, and there is a space between the most projecting point of the lowest displaced spinous process, and the one in situ below it; the body is also bent forward at an acute angle. It has been already proved, at p. 147-8, that this projection cannot take place, unless the posterior half of the vertebra be enlarged or elevated, or the horizontal surface of the anterior half, or the intervertebral substance be diminished or removed, so that, as the anterior half falls forward over its axis, the posterior part and spinous processes must be raised up. Thus, in subluxation, the articulatory processes may be lodged on each other, or the twist of the spine may lodge the posterior sides of the body of one vertebra in a situation to elevate it, and separate its spinous process from, and project it beyond the one below, so as to give the spinous processes above it an acute angle with the body. So also in fracture of the vertebræ, part of the anterior portion of the body of one vertebra may be fractured and depressed,* by which the body of the vertebra above loses its perpendicular support, and inclines forwards, and produces a similar projection of the spinous processes, and distortion of the spine. Mr. C. Bell enumerates “the absence of all the usual symptoms of paralysis” as one characteristic mark of this subluxation; but, in the cases of Messrs. Bond and Dorr, there was paralysis of the lower extremities; in those of Sir A. Cooper and Mr. C. Bell, there was not; so that this symptom is equivocal, and not characteristic. If subluxation be not reduced, “the edges of the articulatory processes may be absorbed,” and the spine accommodated to an erect attitude.

In the case related by Mr. J. Bond,† a partial dislocation of the 4th dorsal vertebra was attended with loss of speech, paralysis of the bladder, and all the parts below the point of subluxation; the dislocation was reduced by extension of the spine, and turning it in a direction opposite to that in which it was luxated, and the patient’s life was saved, although his muscular powers remained imperfect.

Mr. Dorr records a case‡ of partial dislocation of the spine, at the junction of the 1st and 2d lumbar vertebræ, by which paralysis of all the parts below was immediately induced.

* See Plate iii., fig. 4, on Injuries of the Spine, by Mr. C. Bell, and Specimens in different Museums.

† London Med. and Phys. Journal for April, 1813.

‡ Ditto, for August, 1808.

The bones were replaced at first ; but the paralytic symptoms were not relieved or removed by the reduction ; and when the case was published, three years after the accident, the inferior extremities, and parts below the point of subluxation, had become emaciated to an extreme degree ; the tastes had withered, and all venereal orgasm was extinguished ; but the parts above the point of dislocation were in a healthy, firm, and plump condition. Hence, it may be inferred from these and other cases, that death does not necessarily ensue from partial dislocation of the dorsal and lumbar vertebræ. Indeed, the recovery may be perfect. In Sir A. Cooper's case,* and in Mr. C. Bell's,† the boys recovered the free use of their bodies and limbs ; in the former case, the boy remained deformed ; in Mr. C. Bell's, the distortion was cured.

It is the general opinion and belief, that complete dislocation of the dorsal vertebræ is rendered nearly impossible, by any force, without a fracture of the ribs, and of their articulatory processes, being at the same time produced. Dislocation of the lumbar vertebræ is nearly as difficult. This belief is founded on, and confirmed by, the appearances which dissection has presented after death, and the opinion has generally been given, and most readily admitted, from the extraordinary strength and security with which the vertebral joints are articulated. The vertical direction of their articulatory processes, the number and strength of their muscles and ligaments, the little motion allowed to each vertebra, the broad surfaces on which they are supported and connected, and the support the dorsal vertebræ derive from the ribs, all tend to make dislocations of those vertebræ, without fracture, almost impracticable.

It has indeed been stated by a late writer‡ on spinal diseases, that he "has met with many examples of luxation in the dorsal vertebræ, from a gradual enlargement of the articulatory fibres," and he quotes the case of Pratt, of Camden Town, in whom "the 1st lumbar vertebra was found wholly dislocated, and driven into the left loin," where it had remained, at least ten months, without occasioning death ! It is a very curious fact, that of three medical gentlemen who have published accounts of this boy's case, each should give a different version of it.

The boy, say Mr. C. Bell and Mr. Shaw, was knocked down by a stage coach, "the Hampstead," says the latter, and "13 months after died of croup." Dr. E. Harrison considers it a case of spinal curvature, arising from complete dislocation of the 1st lumbar vertebra.

Mr. Shaw says, "the correctness of the following statement is proved by the preparation. There is a *fracture in a horizontal line, in the middle of the first lumbar vertebra, the lower half continuing attached to the other lumbar vertebræ, the upper to the*

* P. 51, on Dislocations and Fractures.

† P. 12, on Injuries of Spine.

‡ Dr. E. Harrison. See Med. and Phys. Journal for Nov. 1821.

dorsal. The two portions are united together obliquely, by a ligamentous matter, so that, at this part, there is *an appearance of dislocation*; but there is not the slightest displacement of any of the other vertebræ. The spinal marrow is completely destroyed at the fractured part.”* Mr. C. Bell’s statement of this case widely differs from the above. “I now place in your hands a very remarkable specimen of *dislocation of the bodies of the vertebræ*. The child was knocked down by a stage-coach, and the separation has taken place between the lowest dorsal and uppermost lumbar vertebræ. *The dislocation, you perceive, is complete*. It may be objected to this statement, that a very small portion of the bone has been broken off; but, the circumstance of real importance is, the tearing asunder of the spinal marrow; — it has been divided and separated. Notwithstanding this extraordinary violence, the child survived, and, 13 months after the accident, died of cramp.” In Mr. Bell’s plate of this injury,† he delineates “a strong ligament which now *unites the displaced vertebræ* in their new relation.”

Dr. Harrison states, that the 1st lumbar vertebra is wholly separated from the lowest dorsal, and the 2d lumbar vertebræ, and is driven into the left loin. Mr. C. Bell says *the dislocation is complete*, but does not represent a total separation of one vertebra from its connexion with those above and below it, as Dr. H. does, and he admits a very small portion of the bone to have been broken off. Mr. Shaw “could not discover any dislocation,” but says, “there is a *fracture in a horizontal line in the middle of the 1st lumbar vertebra, the lower half continuing attached to the other lumbar vertebra, the upper to the dorsal*.” The two portions are united by a ligamentous matter.

“Non nostrum inter vastantas componere lites.”—VIRG.

It may not be singular that Dr. Harrison should differ from Messrs. Bell and Shaw, but “it is passing strange,” that the latter gentlemen should jointly possess the morbid specimen; should be teachers in the same school of anatomy and surgery; and yet describe it so widely different, that one states it to be “a complete dislocation,” and the other, a complete fracture, without any dislocation. This case cannot be allowed to invalidate the opinion, that dislocation of the dorsal and lumbar vertebræ rarely, if ever, occurs without vertebral fracture being, at the same time, induced.

Be this as it may, neither dissection of the dead, nor the appearances of the living, affected with spinal distortions and diseases, nor the museum specimens, have disclosed to me the state of luxation or subluxation, which Dr. E. Harrison considers the cause of spinal curvatures, although my opportunities of performing necrotomy in such cases have been frequent.

* Shaw on Lateral Distortions, p. 75-77.

† Mr. C. Bell on Injuries of the Spine, p. 25, and see his Plate 2, fig. 2, at p. 80.

I have never met an instance in which the oblique processes alone were dislocated. In the case of Jane Weatherhead, already described, the body of the 3d lumbar vertebra was fractured transversely and much absorbed, yet the slightest luxation of the processes or relaxation of their ligaments had not taken place. In confirmation of my opinion, Sir A. Cooper states, that he "has never witnessed the separation of one vertebra from another through the intervertebral substance, without fracture of the articular processes; or, if those processes remain unbroken, without a fracture through the bodies of the vertebræ." — *On Dislocations*, p. 539. In this, my experience corresponds with his.

The os coccygis may be dislocated from the sacrum by a kick or falling on a pointed hard substance. The injury to the neighbouring parts may derange the functions of the rectum and bladder, and excite inflammation about the rectum. The reduction is accomplished by introducing a finger within the rectum, whilst the other hand without enables the surgeon to guide and fix the bones in their proper position. The os coccygis has been dislocated outwardly in parturition, and, in this instance, it can be easily replaced by the fingers. Inflammation should be subsequently guarded against by rest, topical bleeding, fœtus, low diet, and gentle laxatives.

Death generally ensues from sudden dislocation of the cervical vertebræ subject to it, if the reduction be not immediate. There is also considerable danger from subluxation and diastasis, if inflammation supervene. Diastasis of the vertebræ may be regarded as a sort of sprained joint, which is liable to be followed by acute and chronic inflammation of the ligaments, intervertebral substance and membranes of the medulla spinalis, terminating in supuration, paralysis, and death. Subluxation may be followed by the same consequences, and may, from the first period of the injury, produce partial compression of the spinal marrow. Inflammation of the parts enumerated, from these causes, will give rise to pain of the back and head, fever, general excitement, sleeplessness, delirium, trismus, convulsions, disordered respiration, paralysis, involuntary discharge of fæces and urine, which terminate too commonly in death; after which, dissection has disclosed the intervertebral substance, ligaments, and spinal membranes ulcerated and the spinal canal filled with pus. This inflammation should be combated by copious and repeated bleeding, saline purgatives frequently repeated, topical bleeding, mercury, rest, and the antiphlogistic regimen. Should paralysis of the bladder occur, the catheter must be used.

SECT. II. — *On Fractures of the Vertebræ.*

Fractures of the vertebræ have occurred in all the three classes of bones of which the spine is constituted.

Fractures are sometimes partial, and confined to the spinous processes; but, in most instances, the articulating processes and bodies of the vertebræ are broken, and the spinal fracture is complete. Fractures of the spine are generally accompanied with more or less displacement of the bones, which are consequently forced on the medulla spinalis and compress it. In some rare instances, there is no displacement. Of late, an eminent author has divided them "into two classes" or varieties, in consequence of the symptoms and results differing materially from the situation of the injured bones; the first, comprehends those that occur above the 3d cervical vertebra: and the second, those where the injury is below that bone. This division is more properly applicable to fractures of the cervical vertebræ alone; as those of the dorsal and lumbar vertebræ have symptoms somewhat peculiar, as well as the cervical.

When the spinous processes only are broken, symptoms of compression of the spinal marrow do not occur, nor have I met with a distinctly related case, on record, of such an injury being accompanied with symptoms of concussion of the spinal marrow, yet such may take place, if the violence be great that has broken the spinous processes. This injury will be ascertained by an examination, as the spinous processes will be felt loose, and project so as to present the appearance of a distorted spine.

Of the three uppermost cervical vertebræ, the second is the most subject to fracture; its processus dentatus becomes broken, and death will be instantaneous, if the root of the process press forcibly on the medulla spinalis, from the head falling suddenly and heavily forwards upon it. When a fracture of either of the three uppermost cervical vertebræ takes place, and considerable compression is made on the medulla spinalis, death generally ensues immediately from the sudden suspension of respiration, and no particular symptom is induced. Respiration ceases, in this case, with the action of the diaphragm and respiratory muscles, and the diaphragm ceases to contract, because it is deprived of the principle of contraction derived from the phrenic nerve; for, as the phrenic nerve takes its origin from the 3d and 4th cervical pair,* and the medulla spinalis is compressed above its origin, it is deprived of its nervous influence, as well as all the parts below the fracture, which consequently become paralytic. Fracture, however, of these cervical vertebræ, is not necessarily followed by immediate death; for in the case of W. Walker, related by Mr. Kymell in the *Edinburgh Journal*, for April, 1812, the patient survived a fracture of the odontoid process five days.

* Although its origin is generally described as above, "it will be found to unite with the portio dura, par vagum, and 9th or lingualis; and thus we have, in its connexions, as in the results of experiments, proofs that it is one of the great bonds of connexion between the different classes of the respiratory muscles." See Mr. Shaw's excellent paper on the nervous system, in the *Lond. Med. and Phys. Journ.* for June, 1823.

In this case, the head was bent forwards, and the patient's muscles were unable to elevate it to its proper posture. Paralysis was gradually induced. The inferior extremities became numbed and unable to support him, and general lassitude was complained of four days after the accident; on the fifth day, "the paralysis was so complete that he was incapable of the slightest motion. His countenance was of a livid hue, and he spoke with difficulty; the extremities were deprived of sensation and their natural warmth. Suppression of urine and fæces followed, and in raising the patient in bed to evacuate the urine through the catheter, he suddenly expired."

A patient of Mr. Cline, a boy about three years of age, from a severe fall, fractured the first vertebra of the neck across, and deprived the odontoid process of so much of its support, that, in some attitudes, it compressed the spinal marrow. He did not die till about twelve months after the accident. The case is a singular one, but as it is recorded in Sir Astley Cooper's *Treatise on Dislocations*, that is in every one's library, it need not be copied here.

Fractures of the cervical vertebræ, with compression or destruction of the medulla spinalis, below the origins of the phrenic nerve, are not so immediately fatal; they are attended with paralysis of almost all the parts below the point of fracture; that of the inferior extremities of the bladder and sphincter ani is complete; the paralysis of the superior extremities is seldom complete; if the fracture occur at the 6th or 7th cervical vertebra, the patient retains more feeling and power of motion, than if it take place at the 5th; "sometimes one arm is much more affected than the other, when the fracture is oblique and the axillary plexus of nerves is, of course, partly influenced." Respiration is also difficult, and performed by the diaphragm and abdominal muscles, as the intercostal muscles become deprived of nervous influence and lose their power. Priapism is a common symptom—speech is difficult—the abdomen is sometimes tumid and the abdominal muscles paralytic. In a case of fracture of the 7th cervical vertebra, related by Boyer,* the four extremities were completely paralysed, and the patient soon died; in another, recorded by Dr. Gordon,† the paralysis was not so extensive, nor death so expeditious. Sir E. Home relates a case, in which there was paralysis below the fracture, and the œsophagus was affected with great pain, when deglutition of solid food was attempted.‡ When the 4th or 5th cervical vertebra is fractured, the respiration is more affected and death soon induced.

Case.—John Boltwood, aged 24, fell down stairs, and pitched

* Sur les Maladies des Os, tome i., p. 94.

† Edinburgh Journal, for October, 1817.

‡ Philosophical Transactions, May, 1814.

on the back part of the head and neck, on the 6th March, 1811, at six, P.M. He was so extremely intoxicated, that his friends directly put him to bed, without supposing that he had received any injury. I saw him on the following morning, and found him faint, with his skin cool, pulse unusually slow, and respiration much disordered; the 7th cervical vertebra was fractured; and the extremities, bladder, and intestines, were paralytic. The torpor of the system was first roused by ammonia, warm diluents and fomentation to the spinal column. After the heat of the surface was restored, and the languor removed, he was bled, and took a strong purgative; the urine was drawn off by the catheter in copious quantity, as he had not passed any since the accident. The purgative, although repeated, never operated. He became delirious about four o'clock, and died at half-past five. On examination, the body of the 7th cervical was fractured as well as its processes, and the medulla spinalis compressed.

In fractures with displacement of the dorsal portion of the spine, there is paralysis of the bladder, sphincter ani, and the lower extremities; an extraordinary degree of distension of the intestines and abdomen is considered somewhat peculiar to this variety of fracture, arising from their being deprived of so great a portion of their nervous influence, and from the consequent torpor and paralytic state of the abdominal muscles, depriving them of due pressure.

If fracture with displacement occur in the lumbar portion of the vertebral column, the bladder and rectum are paralytic, and the lower extremities are deprived of all motion and sensation. Indeed, the latter are insensible to blows, pinching, pricking with sharp-pointed instruments, and the most painful stimulants to the skin. Blisters will inflame, vesicate, and heal, without the patient being conscious of their application. The circulation proceeds languidly; but the animal heat continues to be generated. Priapism is common, and although the urine be at first retained, for some time before death, it passes off involuntarily in some cases.

The causes of fractures of the vertebræ are, bodies of great weight falling on the upper part of the spine, or on the head and shoulders; falling from elevated situations on the back across some hard matter with a point or edge to it; any forcible propulsion against the spine, as of the shafts of a stage-coach, &c.; gun-shot wounds; caries of the spine. From the three former causes, the fracture is generally through the long diameter of the vertebræ; in the last, it may be across it. The fractured bone, on being displaced, compresses the medulla spinalis; detached splinters of bone may pierce through the theca vertebralis and be fixed in the spinal marrow; a musket-ball may divide either the anterior or posterior portion of the medulla spinalis, and only occasion a loss of sensation or a loss of motion; an instance of the former having occurred to a surgical friend of mine, and the patient is now living,

without any feeling in the lower extremities;* from a rupture of blood-vessels, an extravasation of blood within or without the theca vertebralis, may take place, and compress the spinal marrow; and from its compression, concussion or wound, whether punctured, contused, or lacerated, the immediate paralysis of the muscles and organs below the fracture and displacement, ensues; or it may subsequently supervene from inflammation of the spinal membranes. Caries may be produced either by syphilitic or scrofulous action, occasioning ulcerative absorption of a part of a vertebral bone, and rendering the rest soft and brittle, so that a fracture of its body ensues, by the superincumbent weight of the head and parts above, being thrown upon it in some sudden motion of the spine; whilst the spinous and oblique processes remain entire.

Dissection generally presents the following appearances. The articular and spinous processes of the displaced vertebra are fractured; the spinous process is often depressed; the body of the vertebra is broken through, in an oblique or horizontal direction, and may be pressed forward from half an inch to an inch; the spinal marrow is thereby compressed, bruised, or torn through, in proportion to the degree of injury: or a splinter of bone may remain fixed in it. Blood is sometimes found extravasated between the bony part of the spinal canal, and the theca vertebralis, as well as on the medulla spinalis. When the spinal marrow is lacerated, a bulb is formed at each end of the lacerated part. It also, sometimes, discloses a state of caries. See *Sir A. Cooper's* and *Mr. Kymell's cases already referred to, and Mr. Copeland's case.*† When the fracture of the 2d cervical vertebra occurs from caries, the remaining bone is soft, and much of it is absorbed, previously to its ready fracture. This is attended with displacement. In fracture of the dorsal vertebræ from caries, there may not be any displacement of the articulating processes, or compression on the medulla spinalis, and the fracture is then across the long diameter of the body of the vertebra. See *J. Weatherheads's case*, p. 186. If, however, the articulatory processes be broken after the bodies

* Dr. Ollivier has quoted two cases of this kind (Obs. 17 and 18), in one of which, there was not only a loss of sensation in the lower extremities, but in the scrotum; and the other was affected with a loss of sensation on the left side of the trunk and extremities, and of the abdomen and buttocks. The ball had penetrated the 5th lumbar vertebra, and yet had produced this extraordinary insensibility of the parts above the wound, which confirms an observation to the same effect, made in speaking of the consequences of spinal curvatures. The lost sensibility was restored by four blisters applied in succession, in the course of a month, on the left loin, the left buttock, the hip, and below the trochanter major, p. 182-5. Desault has related a case, in which a musket-ball had penetrated the 10th dorsal vertebra, and had *completely* divided the spinal marrow; yet the patient retained the power of volition over the bladder, the muscles of the pelvis, and the lower extremities, as well as the power of sensation, so that no paralysis ensued.—*Journal de Chirurg.*, tom. iv., p. 137. The immortal discoveries of Mr. C. Bell, on the nervous system, will enable us to understand some of the above circumstances.

† Sir A. Cooper on Dislocations, p. 548.—Copeland on Spinal Diseases, p. 31.

‡ On Spinal Diseases, p. 31.

of the vertebræ have been entirely destroyed by caries, the medulla spinalis is compressed or torn, and death speedily follows. See *Miss Ward's case*, p. 31.

Concussion of the spinal marrow being sometimes attended with as much paralysis of the organs and muscles, as fracture with displacement, a distinction cannot be always established between them; in concussion, however, there is no displacement of the vertebræ, and pressure on one particular spinous process is not attended with more pain than on another; in fracture, one vertebra is often driven inwards, and the spinous process may be felt detached; and, on pressing on the deranged process, much pain is excited. The soft parts may also appear contused and swollen.

Fractures of the vertebræ, with displacement of the bone, from violence, are generally followed by death in a short time.

Fractures without displacement are often fatal; but the duration of life may be more prolonged than in the former instance. If caused by gun-shot wounds, a recovery may take place.

Fractures of the cervical vertebræ above the origin of the phrenic nerve, are speedily fatal, unless caused by caries of the odontoid process, gradually induced. Below the origin of the phrenic nerve, the patients survive such an injury from one to seven days.

In fractures of the dorsal vertebræ, death is said to succeed "in a fortnight, or three weeks;" the patients do not always survive so long, and Sir A. Cooper mentions an instance "of a citizen of London," who lived rather more than nine months after the accident.

Patients die from fractures of the lumbar vertebræ at uncertain periods of time afterwards. Of the first four cases of fractures of the lumbar vertebræ I witnessed, three of them died on the third day, and I begin to set it down as a critical day in such cases; the fourth, however, lived ten weeks; the patient generally dies within the space of four or six weeks after the accident, but may live nearly a year. Boyer thinks one case in 30 may recover, owing to some extraordinary efforts of nature.

The fatality is not so great where fractures have been occasioned by musket balls. Mr. B. Bell mentions a case where a complete recovery was obtained by extracting a musket ball lodged in one of the vertebræ, that had induced symptoms of paralysis. — *B. Bell's Surgery*.

Dr. Ollivier has collected some cases of less complete recovery, ch. iii. Indeed, after fractures of the vertebræ, and wounds of the spinal marrow from musket balls, or cutting and piercing instruments, the recovery of the cases recorded, has, in general, been incomplete, and not of very long duration.

Some defect or loss of sensation in the parts below the point of injury, with pain about the wounded portion of spine, have continued, and, eventually, inflammation of the spinal membranes, or convulsions, have terminated the patient's fate.

This imperfect cure may be partly explained and understood,

by the appearances on dissection of such persons, as it has been generally discovered in such cases, whether the fracture was caused by wounds or violence, that the fractured sides of the vertebræ are not in close apposition, nor perfectly restored to their natural situation, so that a portion of the callus, or of the fractured vertebra has continued to protrude into the spinal canal, and press on the medulla spinalis.

Death, however, is not always induced by the direct injury done to the spine or the spinal marrow; but from other adverse symptoms that supervene from inability to move, and confinement to bed. The patient's condition becomes like that of bed-ridden old persons * Paralysis continues. The circulation of the blood and the generation of animal heat become languid on the skin of the nates and lower extremities. Particular compression on the nates and on the skin over the trochanters from the weight of parts constantly resting on them, still further impairs the circulation; the skin becomes chafed and inflamed; a broad slough of the cutis vera is formed; ulceration and sloughing extend to the bone; a copious fetid discharge ensues; the ulcerated surfaces are irritated by the fæces and urine passed involuntarily; the patient becomes helpless, weak, and dies, either from gradual exhaustion, from the effects of a low fever, or colliquative diarrhœa, and these symptoms may supervene, even after the fracture has united.

When the termination is so generally fatal, the surgical treatment does not interest us much, because it is so rarely successful. Writers of the greatest authority discountenance all attempts to reduce the fractured and displaced bones to their natural situation, for two reasons; first, because, says Boyer, the attempt would not only be useless but dangerous, and the reduction impossible; 2dly, because, says Sir A. Cooper, if the fracture were reduced, every motion would displace it. In cases so hopeless and so fatal, if the displacement be evident and the means of reduction appear to be available, it seems probable that life may be prolonged and the patient's sufferings diminished, by the bones being made to occupy their natural situation as much as possible, and motionless rest on a fracture-bed may be trusted to, to prevent frequent displacement and injury of the spinal marrow. *See Mr. Harrold's Case in a subsequent page.* Bleeding should be employed at first, and fomentations to the back soon after the accident, but the patient should not be subsequently moved for this purpose. Motionless rest on a fracture-bed should be observed. The urine should be drawn off by the catheter at proper intervals, and the bowels assisted by enemata and purgatives. When the bowels are distended, warm laxatives, fomentations and frictions with lin. camph., on the abdomen, will enable them to evacuate the flatus. Compression of the abdomen and its contents with a swathe or roller is beneficial, and is a sort of remedy for the lost power of the abdominal muscles. The spread-

* Fractures of the vertebræ are most common in old people.

ing of ulceration and sloughing may be checked in some degree by cleanliness; by dusting the parts with absorbent powders, as fullers' earth; by plasters; and sometimes by carrot cataplasms; whilst the natural functions are regulated, and the constitution supported by every means.

If the union of the fracture should be accomplished, the muscular action of the bladder, rectum and extremities may be partly or wholly restored, and its return may be favoured by friction of stimulants on the spine and the exit of the spinal nerves, as well as on the extremities, which may be also subjected to artificial exercise and the use of the warm bath. In the case related by Mr. Harrold, in the *London Med. and Phys. Journal*, for November, 1811, the bodies of the 1st and 2d lumbar vertebræ had been fractured, and the 1st driven inwards; a splinter of bone had pierced the theca vertebralis and divided the medulla spinalis; paralysis of the parts and organs below was produced.

In this case, "the fracture was completely and firmly united" (as the preparation in the Museum of the Royal College of Surgeons in London demonstrates), by placing the patient on a fracture-bed, by which the bowels were evacuated without moving the body, and the spine preserved in perfect rest. At the end of six months, the patient's back was strong and flexible. He could retain and pass his urine and fæces, but had a motion only once in three or four days. Neither sensation nor volition were recovered by the lower extremities, but his health was good and mind cheerful. He could dress himself, and went down stairs by supporting himself step by step on his hands and nates. In doing this, he bruised the soft parts over the tuberosity of the ischium, by which their mortification and death of part of the ischium ensued, and the patient died from their effects in ten days less than a year after the accident. The paralysis of the extremities was never entirely removed, and the recovery after vertebral fractures from violence, as after fractures from wounds is seldom perfect.

In Mr. Brooke's museum, there is an anatomical preparation exhibiting fractures of six spinous processes of the dorsal vertebræ, and one fracture across the bodies of the 7th and 8th dorsal. The spinous processes had not been replaced, yet a bony union of their ends had been effected, and there is a considerable osseous deposit on the anterior and lateral parts of the fractured vertebræ. This patient must have survived a considerable time, but the fracture was not completely and fully united as in the last case. In Mr. C. Bell's museum, there is a specimen of a fractured spine, reunited by bone, of which he has given a plate in his work on *Injuries of the Spine, &c.* In both the last specimens, the fractured bone and callus still project into the spinal canal on the medulla. Soemmering has related a case of fracture of the vertebræ, which he has thought of sufficient importance to be the subject of a distinct publication, and in which the union of bone had advanced almost to ossification in three weeks.

Camper relates the case of a soldier who had fractured a lumbar vertebra transversely, in which a perfect union followed and a recovery took place in a year. He died afterwards of fever, and his dissection verified this statement. *Prix de l'Academie Roy. de Chirurgie*, tom. v., p. 828, in 4to.

The present era may be justly considered the epoch of skilful experimental surgery, and of bold and daring operations; so that proposals and suggestions of our ancestors, which have been neglected, now becomes subjected to the test of hazardous experiment.

Many years ago, Dr. Maty first suggested, that the operation of the trepan might be imitated on the vertebral column, either to discharge fluids, or to remove compressing and penetrating bodies from the spinal cord. *Med. Obs.*, vol. iii.

However analogous a fracture of the cranium with depression might appear, on superficial consideration, to a fracture of the vertebræ with compression, the practice of attempting to relieve the spinal cord, in such a state, was reserved for the eminent surgeons of St. Thomas's Hospital, with the sanction of Sir A. Cooper, &c. Mr. Henry Cline performed the operation in one case, in 1814, and the patient died on the second day afterwards. Mr. Tyrrel performed a similar operation, 1822, and the patient died in twelve days afterwards. After Mr. Tyrrel's operation, the bladder and rectum became obedient to volition, but the muscles of locomotion remained paralysed. Some degree of sensation was restored for a few hours after the operation. Symptoms of peritonitis and enteritis supervened before death, and dissection disclosed inflammation of the peritoneum, intestines, and bladder. The portion of spinal membrane uncovered by the trephine, was of a colour resembling parts threatened with gangrene. Sir A. Cooper has described the method of operating adopted by Mr. H. Cline. "He made an incision upon the depressed bone, as the patient was lying on his breast, raising the muscles covering the spinal arch, applied a small trephine to the arch, and cut it through on each side, so as to remove the spinous process, and the arch of bone which pressed upon the spinal marrow."* Mr. Tyrrel employed saws as well as the trepan, in removing the portions of bone judged necessary.

It is much to be regretted, that two highly gifted teachers, in two eminent schools of anatomy and surgery, in this metropolis, should have carried their differences in opinion respecting the propriety of this operation, to such an extent, as to use such epithets and language to each other, as cannot be applicable to the acknowledged talents of either. Who will believe in future ages, that Mr. C. Bell, the indefatigable anatomist and able surgeon, who has immortalized himself by his discoveries of many properties of the nervous system, before unknown, has been alluded to as "a block-head," or "a foolish person"† by Sir A. Cooper, &c.—or who

* On Dislocations, &c., p. 559.

† See Mr. C. Bell on Injuries of the Spine, pp. 18-19.

will suppose that Sir A. Cooper, who is universally acknowledged to be one of the ablest surgeons of the present day, and whose name will be handed down to the latest posterity, for many bold and original operations and improvements in surgery, should be accused of gross "ignorance, and of a wrong mode of teaching," by Mr. C. Bell? * Yet such is the fact. — Such the effect of controversy. — Sir A. Cooper, an ignoramus! — Mr. C. Bell, a block-head! *Credat Judæus.*

The objections to this operation of trephining the spine are, undoubtedly, numerous; and it may be stated, with truth and correctness, that its advocates have not pointed out, with any clearness, such precise and unequivocal symptoms as fully justify and indicate it. These objections are, that the operation is difficult, on account of the thickness of the soft parts covering the spinal column, and of the unequal thickness of the bony bridge; that the diagnosis is not so clear as to indicate whether the attending paralysis be caused by concussion, by extravasation, or compression; by puncture, laceration, or complete division of the medulla spinalis; or by a general protrusion or advancement of the fractured vertebra pressing on the spinal marrow; all of which may accompany, or be effects of, fracture, as well as spiculæ of bone, requiring extraction; that the fractured portion compressing the spinal marrow must often be a portion of that part of the body of the vertebra forming the anterior half or semicircle of the spinal canal; it was so in the cases where the trephine was used, † and the bodies of the vertebræ are commonly fractured. Hence, the surgeon, who had trepanned and extracted the bone on the posterior part of the spinal canal, would find the spinal marrow situated between him and the displaced and compressing portion of bone, which he could not then remove without destroying or injuring the spinal marrow. Inflammation of the spinal membranes would probably ensue after the operation, as in Mr. Tyrrel's case.

There is an analogy of symptoms between compression of the brain and of the medulla spinalis, which extends their relation thus far. Compression of either frequently produces loss of motion and sensation; compression of the brain wholly destroys volition and sensation; compression of the spinal marrow occasions their loss in the parts below it only, or in general.

But this resemblance of effects does not sanction an analogous practice; because the brain is a large mass, of which a small portion only is compressed, and the depressed portion of bone is before us, and lies on its external surface; whereas the medulla spinalis is a very small body, the whole is generally compressed, or it may be entirely lacerated, or divided across, and the portion of bone compressing or destroying it, may be situated on its inner, and not on its outer surface. If the medulla spinalis be

* Mr. C. Bell on Injuries of the Spine — *passim.*

† Ditto — *loc. cit.*

wholly divided, the loss of volition and sensation will not arise from its compression, but from its destroyed continuity, which the extraction of the fractured bone that caused the injury would not restore or unite.

Again, where the patient survives some weeks or months, and escapes the immediate effects of the injury, and of any subsequent inflammation, the patient eventually dies, not from the effects of compression of the spinal marrow, but from induced mortification of the nates and hips, and from death of the bones they cover, such as happens to the old and bed-ridden.

The symptoms denoting compression of the medulla spinalis are all equivocal, in the present state of our knowledge. But, if some symptom or appearance be discovered, which shall distinctly point out the cases in which the spinal marrow is penetrated by, or pressed upon, by a piece of fractured bone, or compressed by the extravasation of blood accompanying a fracture in the posterior half of the circumference of the spinal canal, the experiment of trephining the spine would be justified and the practice vindicated.

The objections offered to this operation cannot be called frivolous or captious; some are forcible and weighty, and must be obviated, or reasoned away, before another attempt can be justified, unless a correct diagnosis of the pre-existence of the precise injury to be relieved by it shall be established.

Let it be even supposed, that the operation has preserved life. What sort of a spine would remain after the bony bridges of two contiguous vertebræ had been sawed away? There would not be any perpendicular support from bone in that part of the spinal column, on its posterior end, in the erect attitude. This part of the spine would also lose all support from its muscles, because their attachments are taken away, so that, from those circumstances, and the want of oblique and lateral processes, the patient would be in danger of having the spine dislocated by its every movement in the erect attitude, and be, in consequence, consigned to his bed for life.

CHAPTER XI.

CONCUSSIONS AND STRETCHING OF THE SPINAL MARROW.

SECT. I. — *Symptoms, History, and Treatment.*

CONCUSSIONS of the medulla spinalis are more common than fractures or dislocations, and are produced by violent blows on the vertebral column; or by persons falling from a height on their

backs across a spar or any rounded eminence of wood or stone, or on their feet or buttocks on a flat surface.

In a situation I held for some years, I had frequent opportunities of seeing accidents occasioning concussion of the medulla spinalis, and once experienced it myself by falling from a height across the rounded edge of a square piece of wood. The symptoms induced may be divided into immediate and consecutive. The immediate or those which occur at the moment of injury, are stupefaction; severe pains of the part affected or contused, so great, that men of great firmness of mind are compelled to give strong expressions of their sufferings; sickness; vomiting; sometimes hemorrhage from the ears or nose; partial or total loss of motion or of sensation, or of both in the lower extremities; sometimes involuntary defecation and micturition; syncope. The external parts of the back are sometimes bruised and swollen and every motion of the body occasions pain. The consecutive symptoms are such, as, in general, arise from inflammation of the spinal cord, or are such as evince more serious lesion and a tendency to death. If not immediately induced, loss of sensation and motion of the lower extremities sometimes gradually supervene, and have been known to ascend by degrees and eventually extend to all the muscles and parts of the body, and occasion death.* Retention of urine may at first take place, but is soon followed by paralysis of the bladder and rectum. If inflammation of the spinal cord ensues, bloody urine, pain of the kidneys, and tenderness of the hypogastrium may supervene, as well as pain of the head and shoulders; delirium; convulsions; trismus; fever; sleeplessness; slight difficulty of deglutition; disordered respiration and moist cough; diarrhœa; sloughs over the sacrum, ilia, and trochanters; death.

A greater or less degree of paralysis of the parts below the affected portion of spinal marrow or contused spine ensues, in proportion to the violence of the shock, the same as in fractures; but in the former case, there is no evidence of displacement from the advancement of a broken vertebra producing a hollow or sinking in of a particular part of the spinal column.

A fracture of the spine without displacement cannot be easily distinguished from a case of concussion, as such cases have been treated for concussion, and the fracture has not been ascertained until after death. Boyer mentions an instance of paralysis of the extremities, rectum and bladder, being induced in a tumbler, on the day after he had, by some difficult evolutions, twisted the ligaments, and stretched the spinal cord. The pain, at the time, was insupportable, and he died in a few weeks.

The prognosis, in concussion of the spinal marrow, should always be guarded, as death has ensued, where the patient's foot has merely slipped, and he has fallen back on his breech, on a slippery

* Ollivier, chap. v.

stone, or polished floor, or on ice; whilst others have fallen from considerable heights, and severe symptoms have been induced, and yet they have recovered. The symptoms may be slight at first, and yet the case may prove fatal.

The recovery may be perfect or imperfect, or the case may be fatal. When the recovery is perfect, and it has been so in many cases in my practice, the morbid symptoms gradually cease; sensation and motion return together by degrees, or sensation may be restored before the power of movement; all spinal pain ceases; the patient acquires strength, and all the functions of the bladder, rectum, &c., recover their healthy powers and action. The recovery of the muscular powers is sometimes rapid, and at other times slow and progressive.

When the recovery is imperfect, the power of locomotion does not regain its obedience to volition, but, in the attempt to walk, the muscles shake the extremities, and render them unsteady, and unable to support the body erect, without the collateral support of a stick or crutch. This accident has been sometimes followed by weakness of the back and lower extremities, by rheumatic pains of the injured portion of spine, and, more rarely, by a complete or incomplete paraplegia, and incontinence of urine; all of which consequences render the cure imperfect. Some cases of pure concussion of the medulla spinalis, without any structural derangement of the brain or medulla spinalis being apparent on dissection, have terminated fatally in a short time.—*Boyer*, tome i., p. 95. *Frank*, *Oratio de Vertebralis Columnæ in morbis dignitate*.

Concussion of the spinal marrow sometimes occasions extravasation of blood, or bloody serum, within or without the theca vertebralis, and, in addition to the usual loss of sensation and volition in the extremities, the respiration shall be disordered. These cases are frequently fatal.

Concussion of the medulla spinalis also gives rise to inflammation of the spinal cord, with serous or bloody effusions, within or without the theca vertebralis, which are both dangerous and fatal.

If the concussion be of the upper portion of the spinal cord, and the dangerous symptoms do not yield to the remedies used, death may be soon expected; and if the concussion be of the lower portion, life may be proportionately prolonged, if the symptoms be not equally violent. There is no clue to direct us to a knowledge of the immediate seat of spinal lesion, unless concussion be caused by a blow inflicted, or a contusion received, on a particular part of the spine, that points it out.

Dissection has disclosed extravasation of blood, in one or more clots or patches, between the spinal canal and the spinal dura mater, or in the cellular texture investing that membrane. All the membranes of the spinal cord have been found either separately torn up or ruptured, or the whole have been lacerated, and have allowed the medulla spinalis to protrude like a hernia, or to escape through the rent, in a mashed condition. The spinal cord has

also presented marks of inflammation, which, in some cases, have been confined to a mere increased vascularity of the membranes or medulla; or the inflammation has altered the structure of the medulla, and rendered it soft and semi-fluid, or it has merely changed its appearance to a yellowish-grey colour. Pus has also been found in the spinal canal, evincing the termination of inflammation in suppuration and death.

It is generally inferred, that concussion does not produce any of the above morbid lesions, except slight inflammation, when the dangerous symptoms that supervene gradually disappear, and the patients recover, as most of those lesions, in general, prove fatal.

The first indication is to prevent or subdue inflammation; the second will be to restore the paralytic state of the organs and extremities. The patient should be bled, and put into a warm or hip bath, or anodyne fomentations applied to the injured part, to soothe pain, as long as they afford relief, and prevent irritation, whilst an opiate should be administered. The patient should be kept in bed and the strictest antiphlogistic regimen, in diet and medicine, should be observed, and the bowels rendered active, by purgative medicines, as long as pain is felt in the injured part. The fomentations should be also repeated. Topical bleeding and blisters are serviceable in removing obscure or chronic pains. After this stage of treatment, friction of stimulating liniments should be made on the spine and lower extremities; artificial exercise of them should be daily employed, until the patient is enabled to perform it by his own voluntary powers. Electricity and tonics, and even diffusible stimuli, are sometimes useful after the inflammatory stage of disease has passed; but it is peculiarly necessary to treat the disorder as inflammatory, as long as any pain remains in the course of the vertebral column, and to continue local bleeding, blisters, &c., until it be removed. Constipation, which is sometimes obstinate, should be obviated, either by gentle aperients, or stronger cathartics, as the case may require.

When paraplegia continues for a long period, whether induced in the first instance, or at a subsequent period; in addition to the topical bleeding, the insertion of caustic issues close to the contused or painful vertebræ, have been attended with favourable or successful results. — See *Dr. Jebb's cases, and the Edinburgh Journal*, for Jan. 1818, p. 59.

Nux vomica should be tried; frictions with the hand or flesh brush, or with stimulating liniments, should be persevered in, as well as artificial exercise of the extremities, and occasional warm baths.

If retention of urine occur at any period of the complaint, the catheter should be introduced to relieve the bladder.

Should any patient continue helpless and bed-ridden for a long period, as after fractures of the vertebræ, sloughing of the soft parts over the sacrum and trochanters, and about the nates or ilia, may arise and require the remedial measures already recommended in such cases, in Chap. X., Sect. II.

CHAPTER XII.

SPINA BIFIDA OR HYDRORACHITIS, AND SOME OTHER CONGENITAL MALFORMATIONS OF THE SPINE.

SECT. I. — *Description of Spina Bifida.*

DROPSY of the spinal canal with bifid spine is a congenital disease, and must consequently be attributed to a defective organization of the fœtus in utero. Dropsy of the spinal canal without producing a bifid spine or an external tumour may be induced at all periods of life. There is, however, one case of Genga's, recorded by Morgagni, E. p. 12, Sect. 9, in which a dropsical tumour of the spine became developed about four years after birth. The difficulty of a dropsy of the spinal canal producing pressure sufficient to occasion absorption and a separation of the bony bridge will explain the rarity of such an occurrence.

Congenital spina bifida is characterised by one or more tumours displaying themselves at one or more points of the spine, or in its whole length. Ruysch says the tumour is small and like a hydatid whilst in the womb. At the period of the birth of the infant or soon after, a soft tumour of different magnitudes, from a pea to a chestnut, is perceived to project in the course of the spinous processes of the vertebral column. The tumour is generally situated on the centre of the lumbar portion of the spine or on the sacrum, or at their junction, and presents itself more rarely on the cervical or dorsal divisions, or at their junction. If seated in the neck, it is often accompanied with a bifid cranium. Wepfer saw one on the right side of the loins. — *Wepferi Observationes*. At first, the tumour may not exceed a pea in size, but in the progress of time is enlarged by distention and growth to the size of a fist, or even of the head, if the patient survive to maturity.* The tumour is either transparent or opaque, as it happens to be covered with or deprived of the common integuments. If the cutis and membrana adiposa be not formed over the tumour or any part of it, it is transparent; if the organization of these over the tumour be complete, it is opaque. The colour of the skin is commonly natural, but shining. The skin is sometimes thin, but it may become thickened, red, horny in parts, erysipelatous, and sloughy. When the skin is wanting, then two of all the membranes of the spinal cord form the cyst. The appearance of the tumour sometimes varies with the attitude of the patient; in the erect posture, it is full, hard, and shining; in the horizontal posture, it is sometimes soft, flabby, and opaque. It may have a broad base of a circular or oval figure, or it may be connected with the spinal cord by

* See Mr. Jukes's case of Spina Bifida, in the Med. and Phys. Journal for February, 1822.

means of a small pedicle. It may be round, conical, or pyriform; or if the whole column be bifid, the tumour projects the whole length.* A fluctuation is distinctly perceptible in the tumour, indicating the contents to be fluid; the centre or summit is usually very thin and soft, from which a fluid recedes on pressure; this fluid can be, in some cases, pressed wholly or nearly so into the spinal sheath, and, in a few cases, the fluid communicates along the spinal canal with water in the brain, so that if pressure be made on the tumour, the anterior fontanelle is evidently distended, and if the pressure be transferred from the tumour to the fontanelle, the tumour becomes distended, and an undulation and an alternate distention are plainly felt.† If there be two or more tumours they communicate, and pressure on one produces an enlargement of the others. If the fluid be evacuated, the tumours at the fontanelle and spine both subside, but it is soon collected again. When the fluid is evacuated or pressed into the spinal canal, it can be clearly ascertained that the organization of the spine is incomplete and deficient, that some of its spinous processes and lateral bridges are wanting, and that the finger can be pressed into the canal; in some instances, however, the tumour protrudes in the shape of a flattened or rounded tube between two separated or divided spinous processes. The fluid is contained in a kind of cyst chiefly formed from the dura mater, arachnoid and pia mater, and sometimes by the latter two. Parts of the tumour are sometimes red or livid. Serous and hydatid cysts, and fungous masses are sometimes found in the vicinity of the tumours.

Some children, born with spina bifida, are also club-footed, and otherwise malformed or imperfectly organized. In some cases, where the disease is local, the general health is not perceptibly impaired; the child is born healthy, large, and strong, and enjoys the use of its extremities, and the bladder and rectum discharge their functions in a perfect manner. The child sucks and sleeps well, and thrives like other children. In some cases, the discharge of fæces and urine is involuntary, even when the muscles of locomotion are obedient to volition.

With this disease, the child may advance to maturity, with all its limbs and structural parts fully developed as to size, but not perfect in shape, and exhibiting a tolerable *embonpoint*.‡ Other cases are attended with paralysis of the pelvic viscera and lower extremities; the growth is stunted, and the patient seldom lives beyond the third year. The integuments covering the tumour are

* Dr. R. Harrison did me the favour to show me some specimens of the latter.

† See Mr. Washbourn's case, London Med. and Phys. Journal for January, 1809, and Dr. Sewall's, in the same Journal for December, 1814. Ephem. Cur. Nat. Decad. 3, Art. 1, Decad. 2, Art. 2; and Cases in Morgagni, Ep. xii. Sect. ix.

‡ Mr. Warner's Cases in Surgery, p. 134, Ed. 4; and Med. and Phys. Journ. for February, 1822.

subject to erysipelatous inflammation, which frequently terminates in gangrene, that, on separation, opens the tumour, and evacuates its contents, which is soon followed by death, whether preceded by spasms, convulsions, and disordered respiration or not. It has been remarked in Dr. Darwin's *Zoonomia*, that gentle pressure on the tumour induces coma, or sleep; but this is not a general consequence. In Ann Selby's case related by Mr. Jukes, already referred to, she became club-footed, and menstruated regularly for three years, in the natural way, and subsequently to that, through deep ulcerations in the ankles and left thigh. The dorsal portion of the spine was curved outwards, and the lumbar portion inwards.

SECT. II. — *Appearances on Dissection.*

The bifid spine has frequently been accompanied with malformation of the genitals or of the feet; with imperforate anus; with change in the order and place of the bladder, lower intestine, and other viscera; and with a deficiency of one kidney or one testis.

On opening the tumour, there escapes a transparent fluid like serum or the fluid of dropsy, which has been contained in a cyst ordinarily formed of the spinal membranes or arachnoid and dura mater, increased in vascularity, and frequently covered with common integument. One or more of the spinous processes and sometimes some of the lateral bridges or processes are wanting from original defective formation: and, in one instance, I have seen a bony deficiency in the anterior part of the sacrum.* The tumour is often local, but an opening or cavity may be sometimes traced from the tumour along the course of the spinal marrow, to the head. There is an opening into the spinal channel, the size of which depends upon the number of spinous and lateral processes deficient, or on the size of the division or cleft in the posterior part of the spine; there may be a considerable tumour when the spinal opening is very small, as Ruysch mentions one as large as a fist, where the opening was not greater than a parsnip seed, and the same author states the tumour to possess the size and appearance of an hydatid before the infant's birth. When spina bifida communicates with hydrocephalus, the cavity containing the fluid can be traced from the spine to the ventricles or to the anterior fontanelle. The analytical chemical properties of the fluid are nearly the same as some other hydropic effusions.†

The traces of spinal marrow and cord can seldom be distinguished in the tumour, opposite the division in the spine; but it sometimes happens, that the medulla spinalis is diffused and expanded over the inner surface of the cyst, with the dilated mem-

* See also Underwood on Diseases of Children, p. 193.

† See the new London Med. and Phys. Journal, loc. cit., and the Analysis of Drs. Marcet and Bostock.

branes of which the pia mater seems divided into stripes on its surface; and it appears to be deficient as a cord in the site of the tumour, and again collects beyond the tumour, in shape and substance and feeling like the medulla spinalis and spinal cord. In other cases, the medulla spinalis or "a substance of an apparently similar nature is continued into the sacrum." See *Tulpius, Morgagni, Abernethy, &c.*

When there are any evident remains of the spinal cord, it is thin and soft. The roots of the nerves, at their points of union to the portion of the medulla spinalis affected by the tumour, are either displaced or drawn out of the spinal canal by the coats of the dropsical cyst or tumour. This derangement is most common when the division of the spine is opposite the termination of the spinal marrow or below it. There is variety in the condition and appearance of the imperfect vertebræ. The whole spine may be divided in its posterior portion. One or more vertebræ may be separated in the whole extent of their long diameter, including the bodies. Tulpius mentions a case in which there was an equal division of all the vertebræ of the loins.* There may be a deficiency of portions of the lateral bridges, or merely a want of union of the bony bridges in the centre of the spine, although fully developed in all other respects. The bony bridge of one or of several vertebræ may be wanting on one side only, or of both together, or a portion may be wanting on one side only in several vertebræ in different parts of the column. When there is but one in this condition, the pyriform shape of the tumour indicates it.

SECT. III. — *Diagnosis.*

This affection can, in general, be distinguished from any other swelling on the spine, by the corresponding deficiency or cleft in the posterior portion of the vertebræ, the bony edges of which can be distinctly felt around the margin of the tumour; by its retreating within the spinal channel on being pressed, frequently by its transparency, softness, and fluctuation; yet it has been mistaken for tumours of a different character, and operations, speedily fatal, have been performed upon them.†

SECT. IV. — *Prognosis.*

The termination of this disease has been almost always fatal. Death is generally induced in a few hours or days after the opening and evacuation of the contents of the tumour, whether it be done by spontaneous rupture, by accident, or by a surgeon, or from gangrene ensuing from erysipelatous inflammation, which lays open

* Obs. Med., tom. iii., cap. 30.

† Mr. Dunning's Case in London Med. and Phys. Journal for March, 1806; and a case in Morgagni, Ep. xii.

the cyst of the tumour. If the opening of the tumour be followed by convulsions, spasms, and disordered respiration, the prognosis is fatal. If the tumour be ruptured during the birth of the infant, it is always still-born.* The infant frequently dies a few days after its birth. The rupture of the tumour at a later period is sometimes followed by marasmus, hectic fever, and death. The larger and more elevated the tumour, the sooner death takes place after birth.

The cases of recovery that have been recorded are very few. Camper and Hoffmant relate one, and Terris another, which took place after a spontaneous rupture. Sir A. Cooper has published two cases of recovery, in the *Medico-Chirurgical Transactions*, and he has been kind enough to inform me of two other cures in his own practice, and of a case of recovery effected by Mr. Hickman, of Marlow, and one by Mr. Pearson, of Kirby Lonsdale.

Although patients in general die early, Bonn mentions one who lived ten years; Warren, one who lived 20. Camper, one who lived 28; and Ann Selby lived 21 years — and some recover, and live an indefinite period. Genga's case, above referred to, was cured. — *Morg., Ep. xii., Sect. xii.*

SECT. V. — *Remote and Proximate Causes.*

These lay hidden among the wonderful and inscrutable arcana of creation. When the infant is born, an imperfection in the Creator's work is evident; but from whence it arose, no satisfactory or rational conjecture can be made, nor has it been ascertained whether the appearance of the parts be an original malformation, or whether the ossific deficiency be caused by the pressure of the fluid, during the uterine growth, or the ossific deficiency have given rise to the dilatation of, and dropsical accumulation within, the theca vertebralis.

The latter case might appear the most probable, as dropsy of the spinal canal does not produce divisions of the spine, in the after periods of life. Is the elementary fluid, from whence medulla spinalis is formed, not organized into medulla? or is the serous fluid of hydrorachitis a subsequent exhalation or secretion from the membranes, occasioning absorption of the medulla spinalis by pressure? At all events, the fluid is secreted after birth, as the cyst soon fills, in general, after an artificial evacuation. It is curious, that this affection does not appear to affect the uterine life of the fœtus, as the infants born with it are generally lively, plump, and well grown.

* Underwood on Diseases of Children.

† Eph. N. C. Dec. 2, A. 6, Obs. 203.

SECT. VI. — *Treatment of Spina Bifida.*

In a disease so fatal as spina bifida, that has almost always baffled the skill and mocked the hopes of those who have formed expectations of curing it, the profession have found themselves justified in instituting experiments, and in trying new remedies. Still the means of cure employed have not been numerous, or much varied. The most rational indication is, to obtain absorption, or a harmless evacuation of the fluid, at an early period, by which a chance might arise, of the bony deficiency being supplied during the subsequent growth of the body. I am not aware that any one has attempted to promote the absorption of the fluid, by the same remedies as are prescribed with that view in dropsy; in one case, I tried a combination of diuretics and aperients, with mercurials; but the patient was withdrawn from my treatment before a fair trial had been given; during the use of these medicines, the disease, however, had not made any progress.

The modes of treatment have been divided into the palliative and curative, and of these the palliative has been most commonly adopted from the failure of the curative. The palliative treatment consists in employing drying plasters and ointments, fomentations, poultices, cold lotions, and in applying bandages, compresses of lint or plaster of Paris, hollowed and lined with lint, and fastened on by adhesive plaster, so as to produce gentle pressure, and promote absorption by means of it. The application of a truss, to prevent the descent and enlargement of the tumour, has been proposed and practised by Sir A. Cooper, with success, in three instances.

The case of James Applebee has been already published, in the *Med.-Chir. Trans.*, vol. ii., p. 323. Besides which, Sir Astley Cooper informs me that a boy, in Coleman Yard, Bunhill Row, wore a truss, and lived for some years, but is now dead. The following is a report of another case, contained in a letter from Mr. Wentworth, of Cambridge, to Sir Astley, who, at my request, most obligingly applied to him for it, and which was treated on the palliative mode, by a truss, &c.

“Having this day to pay our patient my usual weekly visit, for the purpose of examining the back, I took the opportunity of getting the dimensions of the tumour, which are as follow: circumference at the base, $18\frac{1}{2}$ inches; over the tumour, longitudinally, 11 inches; over it laterally, 9 inches: the excoriation which was troublesome some time ago, has entirely subsided, by attention to changing the cap (which he constantly wears) and the use of the oxide of zinc. As a more quiet avocation, our patient has embraced the profession of the law, for which he is most ably qualified. He enjoys, I may say, a very fair share of health, takes plenty of exercise without any inconvenience, and his only complaint appears to be an inability to retain his urine, for a want of power in the neck of the bladder, which is remedied, in a great

measure, occasionally, by the use of the jugum penis. This, however, is not constantly worn."

Previously to noticing any mode of treatment, it should have been observed, that some cases of spina bifida cannot be benefited by any known means; such are those, in which spina bifida is combined with hydrocephalus, and a communication is established between the brain and the tumour, along the whole spinal canal, and those in which the tumour is seated on the upper part of the spine, and the lower extremities are paralytic, and the acts of defecation and micturition are involuntary. The most favourable cases for experiment, or for attempting a cure, are those where there is only one tumour seated low down the spine, where it is small and local, where the general health is good, and the lower extremities and pelvic viscera are not paralytic.

The radical or curative modes of treatment proposed, are pressure applied so as to induce absorption, and the evacuation of the fluid. In some cases, where the tumour had a small base, ligatures have been tried.

The results of evacuating the fluid have been so fatal and discouraging, that, until the publication of this Essay, there were only two or three instances on record, of its proving harmless, out of the numerous trials which have been made at different periods, by different surgeons, so that the old writers advise us to take refuge in discutient plasters and ointments, rather than employ so murderous a remedy.

The tumour has been opened by scalpels, lancets, needles, and small trocars. Opening by the needle or small trocar, is the most judicious and rational; although Ruysch mentions that all the patients whose tumours he saw opened with a needle, died in a few days.* Mr. Abernethy proposed a modification of the treatment by puncture, by which the evacuation of the fluid is conducted in a manner similar to that of the pus in lumbar abscess. After the tumour has been punctured by a needle, or a very fine and small trocar, and the fluid discharged, if the aperture do not close of itself, it is to be closed by means of adhesive plaster, over which a plaster of mild salve, and compress are to be laid, and confined either by adhesive straps or a roller.

After the fluid is discharged, the sac puckers, and falls into wrinkles, and does not contract smoothly, or at all perceptibly. The fluid collects again in three or four days, and should be again evacuated with similar precautions and after-treatment to those already mentioned. After several evacuations had been made, in Sir A. Cooper's case, a piece of pasteboard was placed upon the flannel roller over the tumour, and another roller over the pasteboard to confine it. Three published cases have been treated on

* Nullus enim eorum quibus adfui et sua sponte aut sola acu erupit aqua in hoc tumore contenta evasit, sed omnes fere paucis post diebus exspirarunt. — RUYSCH.

this plan of evacuating the fluid, from time to time, and of thereby exciting adhesive inflammation, and of profiting by pressure at the same time. Those of Mr. Abernethy and of Mr. Richt,* of Berlin, died; Sir Astley Cooper's patient, Little, recovered. In the latter, after nine evacuations had been made, the "surface of the tumour inflamed; the fluid, not more than half its former quantity, was mixed with coagulable lymph, and the child, suffering from considerable constitutional irritation, was ordered scammony and calomel, and the rollers were discontinued. On the next visit, February 26th, the tumour was not more than a quarter of its former size; it felt solid; the integuments were thickened, and it had all the appearance of having undergone the adhesive inflammation. On the 28th, it was still more reduced in size, and felt solid. March 8th. The swelling was very much lessened; the skin over it, thickened and wrinkled; a roller was again had recourse to; a card was put over the tumour, and a second roller was applied. March 11th. The tumour was much reduced; the skin covering it was a little ulcerated. On the 15th, it was flat, and still a little ulcerated. On the 27th, the effused coagulable lymph was considerably reduced in quantity, and of a very firm consistence. On the 2d May, a loose, pendulous bag of skin remained, and the child appearing to be perfectly well, the bandage was soon left off. On the 18th December, the little boy was attacked with the small-pox and went well through the disease. The skin now hangs flaccid from the basis of the sacrum; its centre is drawn to the spine, to which it is united, and thus the appearance of a navel is produced in the tumour by retraction of the skin. The pricks of the needle are very obvious on each of the punctured parts of the tumour, forming slight indentations." — See *Medico-Chirurgical Transactions*, vol. ii., p. 326-329.

Sir A. Cooper permitted me to call on this boy, at Mr. Cockshot's, Regent Street, Black-vall. He is now fifteen years old, and is as stout and healthy as a young man can be. He is an apprentice to a pilot, and is much employed in rowing, and other laborious work. He never lost the use of his limbs, and walked as soon as the other boys of the family. The bandage was left off when he was six months old, and he has not since worn any thing to protect it from external injury. The appearance remains the same as Sir A. Cooper has described it above.

Sir A. Cooper, with a liberality and kind-heartedness that seem towards his professional brethren, has recently favoured me with references to the following cases of spina bifida, treated successfully by puncture.

Master Steiney, now at Friar End Farm, Peckham Rye, was born with spina bifida in the lumbar region, and carried to Sir A. Cooper, when he was six weeks old; this child was punctured 52 times during a year, without the occurrence of an unpleasant

* London Med. and Phys. Journal for July, 1822.

symptom; the tumour gradually subsided, and the boy wore a truss, to protect it from external injury. The boy is now fifteen years old, and is very strong and healthy. His truss is seldom worn, and he employs himself in the laborious office of husbandry, about his father's farm. He has had several falls on his nates and back, without any particular evil ensuing.

The late Mr. Hickman, of Great Marlow, succeeded, in one case, by puncture, some particulars of which have been kindly furnished me by his father, "who had frequently, in the absence of his late son, made the punctures, and had never lost sight of the child, until its death, which was occasioned by confluent small-pox, in its ninth year. The watery tumour was situated on the spine, a little above the sacrum. The skin was shining, and thinly covered with hair, and when pressed upon, the child became uneasy. The mode of cure by puncture, was began about a week after its birth, and repeated every day. The part was afterwards defended by a compress of soft linen rag, and a broad bandage. The fluid that issued from the punctures was transparent, mixed with a light tinge of blood, from the wounded cuticular vessels. The amendment was progressive, and at the end of four months the part was firm, when a common plaster was put on to defend it from accidental friction. The child grew, and got on its feet at the usual time, and was afterwards as active in running and enjoyed as good health as any other child." Aug. 9th, 1824.

Sir A. Cooper mentions, in his note to me, that another case was treated successfully, by Mr. Pearson of Kirby Lonsdale. By this latter gentleman I have been favoured with the following statement:

"I am sorry to say my notes of the case of spina bifida, Sir A. Cooper mentioned to you, are either lost or misplaced; but, from memory, I will, as well as I am able, give you an account of it. I believe it was the last lumbar vertebræ and a part of the sacrum which were imperfect, and over which a tumour, perhaps about the size of half an orange, protruded; the integuments covering the most prominent part were very thin and nearly transparent. A very short time after the birth of the child, I punctured it with the point of my lancet, when a considerable quantity of fluid, transparent as water, was discharged; long straps of adhesive plaster were applied (upon which I principally relied for support); over these a linen compress was retained by means of a flannel roller; in about a week's time, the tumour had increased to its original size; it was again punctured, and again gradually it increased, so that a third time it was necessary to discharge its contents, which were now not near so transparent as before; inflammation came on in the part, and the infant was seized with convulsions, from which, however, it soon recovered, and was, a year ago, when the family left our neighbourhood, a fine healthy boy."

ALEXANDER PEARSON.

It is supposed that a covering of common integument is necessary to the success of this mode of treatment, for if the cyst be formed of dura mater only, it is said, the opening will never close.

Okes on Spina Bifida.

The tumour has been opened with caustics, but the issue has been invariably fatal. The application of the ligature to the tumours with a small base, has been equally unsuccessful, as the cases published by Tulpus* and Mr. Dunning evince. In the case related by Mr. Dunning, and already referred to, the tumour was situated in the middle of the cervical vertebræ.

From the effects of the modes of treatment mentioned, it is inferred, that all the palliative remedies may be used without injury, provided pressure be employed with discretion, and be moderate. But, of all the curative means and operations that have been resorted to for a radical cure, only one operation appears justifiable, which is the modified one by evacuation, proposed by Mr. Abernethy, and practised with success in the above instances, by Sir Astley Cooper, Messrs. Hickman and Pearson. But the profession are at liberty to attempt the evacuation by any means adapted to the cure of dropsies in general, with safety to the patient.

This disease has been termed by some hernia of the medulla spinalis;† this appellation, however, more properly belongs to a swelling of the spine, which does not always contain water, but in which there issues from the spinal channel a fleshy substance, or spongy medulla, similar to the hernia cerebri. The tumour is not soft and fluctuating, but firm and thick, and infants affected with it cannot lie on their backs without convulsions being induced.

As the following case of spina bifida is the most singular on record; as the patient has lately died, and I have been favoured with some further particulars of her case and dissection, I shall transcribe Mr. Jukes's description from the London Medical and Physical Journal for January, 1822, and give some additional particulars.

"Ann Selby, aged about nineteen years, residing with her parents in the Horseferry-road, Westminster, was born with a slight membranous tumour, the size of a small pigeon's egg, situated on the superior portion of the sacrum, and below the third lumbar vertebra. She was, in every other respect, well formed, and continued to grow in the most satisfactory manner, until the age of eight years; walking about the house, without much inconvenience from the tumour, the latter being supported by an appropriate bandage. At this period, the right foot began to contract and turn inwards and upwards; the tumour continuing, at the same time, to increase.

"At eleven years of age, menstruation became fully established in the usual manner.

"At fourteen, the menses ceased to flow from the natural passage,

*Tulpii Observationes Medicinæ.

† Opere di Ambrogio Bertrandi. Tome ii. Torino, 1786.

and made their appearance through certain deep ulcerations, which had formed, and still exist, in the ankles and fleshy part of the left thigh. This fact respecting menstruation is incontestable, and has been verified by several particulars.

"When fifteen years old, the left foot of the patient contracted also, and turned towards the right.

"The vertical line of the tumour measures thirty inches; the greatest circumference twenty-eight inches; and the lesser, twenty inches.

"The tumour is transparent, equally distended, fluctuating, and occasionally larger than at other times. A kind of horny scale, not quite as large as half-a-crown, which occasionally peels off from the surface of the tumour, and leaving the skin without its cuticle, gives rise to a very perceptible oozing of a serous fluid, which, after a short time, ceases; some of it drying in thin layers, and leaving the horny scale above described.

"Neither the urine nor the fæces have ever been retained, but pass involuntarily and almost constantly.

"During the last two years, the health of the patient has been sensibly declining, and from being corpulent, she is now wasted almost to a skeleton. The stomach rejects every kind of food, unless accompanied by a large quantity of gin, which forms her only drink, and, indeed, almost her only support. The development of her intellectual faculties seems in no way to have been influenced by the formidable disease with which she is afflicted, and which she bears with becoming resignation."

Subsequently to this report of Mr. Jukes, the tumour became subject to erysipelatous inflammation, the last attack of which terminated in mortification, and on the separation of the slough the tumour was evacuated, and the patient soon died. The tumour contained seven pints of a serous fluid. The cyst in which it was contained was thick and vascular, its outer coat was formed of skin, and the inner of expanded and thickened membranes of the spinal marrow, somewhat vascular. The lumbar vertebræ, pelvis, and tumour were privately taken away, and I have not the permission of their possessor to state the particulars of their appearance.

I may, however, venture to add, that the posterior and nearly all the lateral bony coverings of the spinal canal were wanting, from the 5th lumbar vertebra to the end of the sacrum, and progressive absorption had commenced on some parts of the anterior portion. The nerves are regularly sent off, until the medulla spinalis enters the sac of the tumour.

Much fat was found in all parts of the body; the bones were firm and solid, even within the capsular ligaments of the hip-joints; a circumstance which strongly militates against the notion of a recumbent posture long observed, always conducing to a rickety or soft state of bone, or one in which there is a deficiency of earthy matter, for Mr. E. Jukes has very lately assured me, the patient was never able to walk about and take exercise from her eighth year, after the right foot contracted and turned inwards.

As the subject of the Essay is limited to "Diseases of the Spine" by the Society, it will not be expected that its other congenital malformations and imperfections should be described with any minuteness of particulars, and yet it may prove satisfactory to the reader, if a short sketch of some of them be drawn, or if only a kind of enumeration or catalogue raisonnée of those imperfections be made.

The spinal marrow has been entirely wanting. As yet, however, the medulla spinalis, as part of the nervous system, has not been *solely* deficient, whilst the brain was entire, but in all cases of the absence of the spinal marrow, the amyelous human being has been simultaneously anencephalous or without a brain.* In a case related by Dr. Clarke, there was not a trace of any portion of the nervous system.† In one instance of the defect of brain and spinal marrow, the head and spine formed a solid mass of bone, so that the spinal canal, in all probability, had never been formed.‡ Fœtuses with these defective organizations generally die immediately, or are born dead.

In some modern instances of fœtuses born without any appearance of brain or spinal marrow, which are called by Mons. Beclard amyelencephalous, and which have been examined with accuracy, the membranes of the brain and spinal marrow form membranous pouches or pipes filled with a yellow and viscid fluid, if it have not been evacuated during parturition, in which case the cranium and spinal channel only contain the flaccid membranes. Sometimes these membranes have been supposed to be filled with the dropsical fluid of hydrorachis, which, by its pressure has occasioned absorption of the elementary or perfect medulla; at all events, the generality of instances, in which the spinal marrow and brain have been wanting, have been accompanied with a bifid or defective spine, and are properly noticed here. It is generally supposed that, the yellowish and viscid fluid contained in the membranes of the cranium and spinal canal is the elementary fluid or rudiment, from which solid brain and spinal marrow are usually organized, whose perfect organization, from some unknown cause, has been suspended or has ceased. In most cases, the origin of the spinal nerves is deranged or deficient. Besides the total absence of all perfectly organized brain and medulla spinalis, various instances have been recorded of different kinds and degrees of imperfection. For instance, when the fœtus is born anencephalous or without brain, there is commonly a deficiency in the cervical portion of the spinal canal; the same occurs when a fœtal monster is born acephalous or without a head. The spinal marrow may be formed into two portions instead of being continuous: or it will be found bifurcated or forked in the monsters born with two heads and one body, or in those

* Morgagni, Ep. xii. de sed et causis; et Ep. xlviii.

† Ph. Trans. 1793. This was a monster of imperfections.

‡ Morgagni, loco citato.

born with one head and two bodies. Its length and size may be irregular and a canal may exist in its internal structure. Even in the generality of those instances the spine has been bifid or otherwise imperfect. When the spinal marrow has been longer than usual, it has been generally found so in the cases of *spina bifida*. Indeed, as a knowledge of those monstrosities is rather curious than of practical utility, and as such imperfect beings do not live, I shall content myself with this brief notice of them, and refer the curious reader to a more full account of those defects and imperfections by Dr. Ollivier, *Partie III., Chap., I^{er}, De la Moelle Epiniere*; and to Morgagni, *Ep. xii.*

SECT. VII. — *Atrophy or Destroyed Continuity of the Spinal Marrow.*

The spinal marrow may be diminished by different causes, and may occur whether the spinal canal be diminished or contracted or not. The spinal canal may be contracted from a stunted growth of some vertebræ or from their destruction, in which case, there will be a partial diminution of the spinal marrow also at that part, such as has been described as occurring in the excursions of the spine and in the angular projection, when speaking of the effects of those distortions on the bones and *medulla spinalis*. A diminution of the size of the spinal cord and marrow occasionally occurs in old age, when the canal is of its natural calibre, and may account for the feeble and unsteady gait of some old people. A diminution may be occasioned by any effusion into the spinal canal producing absorption by its pressure. The continuity of the spinal marrow has been destroyed in some parts of it, chiefly in the vicinity of carious vertebræ at the angle of inclination or the centre of curvature of the spine, where such distortions have ensued from carious or absorbed vertebræ.

None of the above changes can be strictly attributed to atrophy or defective nutrition of the *medulla spinalis*, but such a condition of the nutritive vessels may be supposed when a remarkable diminution of size in the whole extent of the spinal marrow takes place in patients affected with hemiplegia on the paralytic side. The lumbar portion of the spinal marrow as well as the lumbar nerves have been found withered in patients who have died affected with paraplegia. Atrophy of the spinal marrow and loss of continuity occur in the epileptic, idiotic, hemiplegic, and paraplegic subjects, and in those affected with spinal distortions from the ulcerative or progressive absorption of the vertebræ.

No diagnosis of such a state of the spine can be established from our present knowledge of spinal diseases, more particularly as the partial diminution of the spinal marrow and its destruction of continuity have occurred without producing insensibility or muscular paralysis. Cases of this kind have been referred to in this Essay, to which the following by Dr. Ollivier may be added.

Towards the close of 1820, a child between 8 and 9 years old, with all the symptoms of a scrofulous diathesis, died in a state of complete marasmus. It had been long affected with caries of the spine, attended with a constant and intense headache; the lower extremities preserved the power of volition and most correct sensation until its death. The appearance of the different viscera is recorded, but it will be sufficient for my purpose to state, that there was a complete destruction of the medulla spinalis from the 9th dorsal to the 1st lumbar vertebra. The membranes were entire. The upper portion of medulla terminated in a bulb. The lower portion was compressed. There was a partial caries of the nine superior dorsal vertebræ, whilst the three lower were completely destroyed. The articulatory processes of the 4th, 5th, 6th, 7th, and 8th ribs on the left side were also destroyed, as well as the articulatory processes of the corresponding vertebræ. The bone appeared to be converted into a pulsatious mass, mixed with dark grumous blood. Where the 9th dorsal vertebra approached the 1st lumbar, the spine was inflected forwards at an acute angle, and it was between those portions of the spine that the spinal marrow had been absorbed. The lower extremities were wasted, and there was a small abscess in the left psoas muscle.

This will hardly be regarded as an idiopathic case of atrophy of the spinal marrow, although detailed under this head by the learned indefatigable author.

CHAPTER XIII.

INFLAMMATION OF THE MEDULLA SPINALIS AND ITS MEMBRANES.

SECT. I. — *Symptoms and Progress of the Disease.*

INFLAMMATION of the spinal cord, may be distinguished into acute and chronic, without adopting the distinction into arachnitis spinalis and myelitis, or inflammation of the spinal marrow, and arachnoid membrane, for reasons that will be assigned in the section on Diagnosis. Like other inflammations, it terminates in resolution, suppuration, in effusions of serum and blood, in softening of the medulla, and in thickening and induration of its membranes.

Acute inflammation sometimes supervenes in a very gradual manner; at other times, it is induced at once; in the former case, the disease has been considered as chronic, by some authors, contrary to the established rule of nosologists, which defines the chronic to be the sequela to the acute state of disease. This departure from common usage rather embarrasses the subject, and confuses their descriptions. I shall, therefore, endeavour to describe the disease, chiefly from my own experience.

When it comes on in a gradual manner, it is frequently preceded by pains of the head, but more particularly of the occiput; pain of the head is also a common symptom in all stages of the disorder, but it comes on in paroxysms of longer or shorter duration, and is not always present. From the head, the pain is described as descending in succession to the neck, back, and loins; it sometimes passes over the cervical vertebræ, to fix at once in the dorsal. When it is seated in the cervical vertebræ, it produces pain and rigidity of the muscles of the neck, as well as of the vertebræ, and every motion increases the pain; the dorsal portion of the spine, however, generally becomes the seat of the disease, either primarily or successively. From the dorsal vertebræ, the pain sometimes spreads all over the body, and renders the patient unable to lift or move the arms or lower extremities, without great pain; pressure on the affected portion of the spine occasions severe pain, and appears to affect all the outer layer of the dorsal muscles.

In one case that anodyne fomentations were twice applied to the painful spine, the patient became sick, and fainted away at each application, although it appeared to give ease.

Sometimes the pain shoots along the whole course of the spine. Some degree of fever is induced, and accompanies it, and seems to be proportioned to the extent of spinal pain; the fever is attended with frequency of pulse, thirst, and a white tongue; as the pain becomes transferred to the spine, the head seems to be relieved, the appetite becomes impaired or lost, the stomach is sometimes affected with vomiting, the bowels are sometimes obstinately and permanently costive, the sleep is interrupted and disturbed, the patients become fretful and nervous, and such a state of lassitude, listlessness, and despondence is felt, as disqualify them for exertion; a loss of power in the muscles of the back, and of the upper and lower extremities, is soon induced, and fatigue speedily ensues from exercise; walking sometimes gives a painful shock to the head and spine, particularly if the body be jarred by a slip or false step. Walking frequently induces palpitation of the heart, and dyspnœa, and the latter is generally brought on by going up stairs, or walking on any ascending ground. The dorsal horizontal posture affords most relief from pain, and is always sought by the patient; but, even when lying on the back, the patient is scarcely able to use the arms; when patients are lying down, they are sometimes unable to move themselves at all; and, in general, they cannot raise themselves up with their arms, but are under the necessity of being lifted up most carefully by the hands of assistants placed behind the shoulders.

When the spinal pain is severe, the patient is unable to move the extremities or the body without increasing it. Sometimes all the muscles of the extremities are affected with temporary spasmodic contractions; in other cases, some particular muscles, as of one leg, are affected with irregular movements, like chorea sancti vitæ; or the flexors of the thumb, and some fingers of one hand,

and of two or three fingers of the other, shall be permanently contracted, as occurred in the case of Miller, 13 Chesterfield Street. Sometimes the muscles of the neck are stiff, hard, and tender on pressure, and sometimes the pain there, with or without pressure, spreads to the dorsal muscles, and, in fact, all over the body. If the disease be not cured or checked in its career, in its incipient stage, the pain in some portion of the spine, generally in its inferior part, becomes increased to an intense degree, rather unexpectedly, and may at once occasion convulsions and death. This intense pain of a particular part of the spine, is sometimes compared to the sensation of burning, that is sometimes followed by a sense of extreme coldness in the same place. The course of the disease is, however, rarely so rapid. The increase of pain is accompanied with fever, and pain extends from the spine around the body, and the spine of the ilium. All the organs and muscles that derive their nerves from the spinal marrow, are liable to become disordered, as well as the organs of sense. Sensation is not so much affected as the power of motion. The fever is accompanied with quick pulse, and restlessness and vomiting are induced. The abdomen and bowels are sometimes affected with uneasiness, distention, or great pain; the bowels are costive, but are often easily acted upon by purgatives; defæcation increases the pain in the spine, and the discharge of fæces is sometimes involuntary; there may be retention of urine, or great pain and difficulty in passing it. In many cases, the lower limbs become entirely paralytic, or nearly so; and when the power of locomotion is preserved, the dorsal pain may induce the patient to walk about in extreme agitation and suffering, to grasp his back with his hands, and try various attitudes and positions for relief, in vain; perspiration is frequently free and profuse; the eyes become affected with strabismus or convulsive motions, the articulation of the voice indistinct, and language incoherent; spasmodic twitchings of the face may occur; some difficulty of swallowing ensues; laborious respiration, trismus, coma, delirium, and convulsions close the scene. Sometimes, however, the patient is gradually worn out by irritation. Cold shiverings sometimes occur a few days before death, and sometimes the nates ulcerate. Inflammation of the spinal cord is sometimes induced at once in a more rapid manner, and its fearful and destructive symptoms have been detailed by Dr. Goelis, with much perspicuity and accuracy. This complaint is ushered in with inflammatory fever, and, generally, with spasms of the lower extremities.

From the first, the patient chooses the dorsal horizontal position. A species of tetanus contracts the cervical and dorsal muscles, by which the head is drawn backwards, the spine curved inwards, and the legs closely pressed together, resembling, in some respects, the dreadful contractions in the last stage of tetanus. The humeral parts of the upper extremities are pressed close to the thorax, whilst the fore-arms are moved involuntarily to parts of the

face, thorax, or abdomen. Sudden convulsions of the muscles, like electric shocks, shake the whole body. The face is red and hot; the countenance expressive of pain that is increased on every motion. The patient complains of severe pain in the back, and sometimes cries aloud, and the pain is attended with inability to move the extremities, or to turn in bed. The eye wanders, the pupil is contracted, and its sensibility to light increased; the nose is dry, and the lip pale, however red the face. The tongue is white, there is anorexia, the thirst is excessive, and drink is incessantly demanded, even if it has been just rejected by vomiting. The patients are bathed in perspiration, and the urine is scanty. The bowels are easily acted upon by purgatives, and diarrhœa is occasionally induced. The inflammation sometimes extends to the brain, and the eye becomes insensible to light. Convulsions, or apoplexy generally cut off the patient within thirty-six hours, or it terminates in some effusion of the spinal cord, and the patient's life is protracted a few days longer.

When the patient recovers, the more urgent symptoms yield, but the fever continues for several days. In some cases of spinal, complicated with cerebral arachnitis, a remission of symptoms will take place, for one, two, or three days, which may excite delusive expectations of a speedy recovery, as they return with equal severity and violence. Indeed, where remissions or intermissions alternate with exacerbation of symptoms, the marks of recovery become fallacious, and the disease at last subsides, and leaves the patient at an unexpected period. I have observed that females, who are attacked with acute and severe symptoms, suffer very considerable pain in their mammæ, and sometimes in the uterus and pelvic viscera. Chronic inflammation is sketched out in the Sect. on the Treatment.

SECT. II. — *Appearances on Dissection.*

When it is intended to examine the spinal canal and its contents the dissection should be begun by separating the integuments and muscles from the spinous and lateral processes of the vertebral column, after which, the vertebræ are to be sawn through at a proper distance on each side of the spinous processes, and the posterior portion of the spine forming the spinal canal carefully raised.

It very seldom happens that inflammation of the membranes of the spinal marrow occurs without being combined with inflammation of the cerebral membranes. The membranes enclosing the medulla spinalis are sometimes found to have been in a state of inflammation, and are red, vascular, and a little thickened; at other times, the theca is, in a particular part, like an empty bag, yet vascular and thickened. The arachnoid is sometimes opaque and pervaded with a serous fluid, either in the whole or a part of

the spinal cord, and is so where spinal has been combined with cerebral arachnitis. On dividing the membranes, purulent matter may be found to pervade the whole, or part of the extent of the spinal canal; or a serous fluid or a sanious fluid, or blood may be discovered within it, and these fluids may be seated between the spinal canal and its membranes, or between the membranes themselves; the most common fluid is pus. Sometimes the purulent, or other fluid, appears to have gravitated along the course of the spine from a part above particularly ulcerated. Sometimes suppuration appears to have taken place along the whole length of the medulla spinalis, yet the matter collects more in one part of it than another, especially at the top of the sacrum. The medulla spinalis becomes soft, dissolved, and disorganized by suppuration and ulcerative absorption, and one case is recorded by Mr. Copeland,* in which more than two inches of the medulla were entirely destroyed by ulcerative absorption, or the absorption from the pressure of some accumulated fluid. The membranes and spinal ligament lining the canal have likewise been destroyed. The soft state of the medulla spinalis is thought, in some cases, to be like the brain rendered semifluid by putrefaction. It is also in some places occasionally divided into filaments. Dr. Reid mentions a case in which a whitish substance, somewhat like medullary matter, was effused between the tunica arachnoides and pia mater for an inch and a half, covering half the circumference of the nervous mass. — *London Med. and Phys. Journal*, October, 1818.

The visceral contents of the cranium, thorax, abdomen, and pelvis are generally sound. Lieutaud mentions one case, and quotes another from Lælius a Fonte, in which the kidneys were affected on the same side as the medulla spinalis, and were black like it.† Some serous effusion is occasionally found in the brain, and, on taking out the cerebellum, purulent or serous fluid sometimes flows from the spinal canal.

The above cases, from Lieutaud and Lælius a Fonte, are not the only ones in which the medulla spinalis is solely inflamed on one side; Pr. Brera mentions the case of a young man, aged 19, who, after receiving a contusion on his right thumb, became affected with inflammation of the medulla spinalis from the lower cervical vertebræ to its extremity, and with tetanus, and on dissection, it was remarkable that the inflammation of the medulla was entirely confined to the right side. This might be considered a case of traumatic tetanus.

SECT. III. — *Prognosis and Diagnosis.*

The disease may be expected to terminate favourably, when it

* Copeland on the Diseased Spine, p. 50.

† Lieutaud, tom. i., Obs. 1072 and 1109.

is early detected, and the remedies employed diminish the spinal and cerebral pains and fever, and ward off complete paralysis and convulsions. If these pains and fever be suddenly increased, and followed by paralysis or convulsions, the case is dangerous. If these symptoms be preceded with cold shiverings, and are accompanied with trismus or tetanus, delirium, coma, paralytic or convulsive states of the organs of sense and of speech, restlessness, disordered respiration, vomiting, involuntary discharges of fæces and urine, quick pulse, and profuse perspiration, it may be inferred that a purulent or serous effusion has taken place in the spinal cord, and that death will soon ensue.

Diagnosis. — Inflammation of the spinal cord has recently been distinguished by Dr. Ollivier, &c., into two varieties, termed arachnitis spinalis and myelitis, or inflammation of the arachnoid membrane, and of the spinal marrow. After an attentive perusal of the cases, descriptions and opinions that have been published, if I may be allowed to trust my own experience and judgment, I would say that a correct diagnosis has not been established between them, and that the assumed discrimination has not led to any practical advantage. The reasons for this dissent are offered with diffidence and respectful deference to those who have endeavoured to establish this distinction. The diagnostic symptoms of spinal arachnitis are assumed by Drs. Parent-Duchatelet, Martinet, and Ollivier, to be two; first, a spasmodic contraction of the muscles on the posterior part of the trunk, varying in degree from a simple rigidity to an immoveable opisthotonos, which draws the head and spine backwards; and 2dly, a pain more or less acute in some part of the spine or back.* The diagnostic signs of myelitis are supposed to be a very acute and deep-seated pain of the spine, accompanied with a burning sensation along the spine, and particularly exasperated by spinal movements. Pressure does not affect it; but lying in the dorsal position on a feather bed is said to increase it.† It may be urged against the certainty and correctness of those diagnostic symptoms, that spasmodic rigidity and contraction of the spinal muscles and opisthotonos, are considered pathognomonic signs of tetanus, and a case related as one of spinal arachnitis, was connected with traumatic tetanus, in which there were trismus and rigid contraction of the trunk.‡ Now tetanus is surely oftener a purely spasmodic disease, than combined with spinal arachnitis. 2dly. That pain of the back, more or less acute, even with a burn-

* On voit qu'il existe deux symptômes qu'on pourrait appeller, en quelque sorte, signes pathognomoniques de l'arachnitis rachidienne, &c. Le premier consiste dans une contraction générale des muscles de la partie postérieure du tronc, laquelle peut varier depuis la simple rigidité musculaire jusqu'à la contraction la plus violente, d'où il résulte un véritable opisthotonos, &c. Le second symptôme est une douleur, plus ou moins vive dans la région du dos. — Ollivier, p. 314.

† Ollivier, p. 348.

‡ See Recherches sur l'Inflammation de l'Arachnoïde Cérébral et Spinal, &c. par Parent-Duchatelet, M.D. L. L. Martinet, M.D. Observ. or Case xiv.

ing sensation, are common also to spinal rheumatism, to fevers, and diseased vertebræ. 3dly. All the cases published under the head of idiopathic spinal arachnitis have been discovered, on dissection, to be complicated with equal lesion or disease of the cranial contents, and all the cases related by the two first physicians were combined with cerebral arachnitis. 4thly. The supposed cases of pure myelitis or of the substance of the spinal marrow have also been found on dissection complicated with disease of the brain, or of other parts of the spine, or connected with other diseases. Thus dissection has disclosed it combined with carious vertebræ, with similar cerebral disease, with pultaceous softening simultaneously and equally of the substance of the brain and spinal marrow, or purulent or serous, or sanguineous effusions between the canal and membranes, or between the membranes and spinal marrow; so that, in fact, no case of simple myelitis has been published. The 68th and 69th cases of Dr. Ollivier may be with more propriety considered cases of inflamed membranes generally, and of carious vertebræ, than instances of pure myelitis; indeed, so small is the spinal cord, that inflammation generally affects its whole structure, instead of being confined to particular anatomical divisions of it. Dr. Ollivier on this subject states, that all the membranes of the spinal marrow in spinal arachnitis are more or less injected; and in the next paragraph affirms, that no blood-vessels have ever been found in the spinal arachnoid, and that its apparent redness is derived from the subjacent vessels.* Lastly, It may be observed, that no necessity exists for the diagnosis, as no practical utility is likely to be derived from it; for it is laid down in its treatment, that the remedies employed to combat myelitis, are nearly the same as those which have been enumerated for spinal arachnitis.†

It seems of importance to distinguish inflammation of the spinal cord from lumbago, and inflammation of the other constituent parts of the vertebral column. In lumbago, pressure on the muscles of the back commonly gives much greater pain than pressure on the spinous processes; in inflammation of the spine, pressure on the spinous processes increases the pain, whilst pressure on the muscles hardly affects it. In lumbago, the dorsal muscles are rigid, and their motion and action are attended with pain; in inflammation of the spinal cord, the muscles are not always rigid, and their movements may be without muscular pain, or if pain be induced by their muscular contraction, it does not feel as if it were seated in the muscles, but within the spine. In lumbago, there is seldom a pain of the head, which so generally accompanies inflammation of the spinal cord.

* Ollivier, p. 297.

† Les moyens qu'on peut employer pour combattre cette inflammation sont à peu près les mêmes que ceux qui ont été indiqués pour l'arachnitis rachidienne. — Ollivier, p. 354.

In scrofulous or other inflammation of the bones, intervertebral substance, and ligaments of the vertebral column, the pain is obscure and not constant ; is seldom attended with fever and loss of appetite ; and is perhaps only felt on pressure, or when the patient has observed the erect attitude for some time, and it is generally accompanied with some degree of spinal distortion ; the upper extremities are not so weak, the patient can move in bed, and does not find such great relief from lying on the back. In inflammation of the spine, the pain is commonly constant ; is attended with fever ; anorexia ; headache, and great muscular debility or partial paralysis of the upper and lower extremities ; the patients find most relief from the dorsal horizontal position, and yet, when lying down, they are not able to move their bodies or raise themselves up, which I consider a strong and striking characteristic symptom, although, when erect, they can move about even tolerably well ; there is no distortion of the spine. I have not observed the sense of corded tightness across the epigastre in inflammation of the spinal cord, which is so common in excurvation of the spine. It need hardly be observed, that all the more dangerous and fatal symptoms of inflammation and suppuration of the spinal cord are not present in inflammation of the other parts of the vertebral column.

SECT. IV. — *Causes of Inflammation of the Spinal Cord.*

The remote causes of inflammation of the spinal cord, in the cases that are published, and in my practice, have been contusions on the spine ; strains ; tumours pressing on it ; suppressed discharges, as of the ears, vagina and uterus ; carious vertebræ ; metastasis of inflammation ; cold or suppressed perspiration. The immediate cause is inflammatory action of the blood-vessels of the medulla and membranes. When it is considered that the medulla spinalis is a continuation of both divisions of the brain, that the membranes are also continuous, and that the nerves of all the viscera and muscles below the head derive their origin from it, and that the due performance of their functions depends upon the healthy condition of their nerves, and that, in fact, all motion and sensation arise from it, it will not be a matter of surprise that the phenomena attending the disease, include derangements of all the principal organs and functions. The brain becomes affected, and the intellectual motions are deranged and imperfect ; the muscular movements of the organs of sense and of the muscles supplied with nerves from the brain, are disordered and irregular. The heart is oppressed and affected with palpitation or increased action ; the lungs and muscles subservient to respiration perform it with labour and difficulty. The abdominal and pelvic viscera become deranged in the manner that has been already described. All the muscles are affected with debility or paralysis, or irregular spasmodic

actions like chorea, or with convulsive actions like epilepsy or tetanus. And these are the dreadful effects of inflammation of this small but important portion of our frame, which is so enclosed and defended as if it were intended to be impenetrable and inaccessible to disease.

SECT. V. — *Treatment.*

The sole indication in the treatment is to subdue inflammation. This is to be fulfilled by general and local bleeding, by purgatives, febrifuge medicines, diaphoretics, blisters, low regimen, and mercury.

Blood should be drawn from the arm until the pain be relieved, and the operation should be repeated as often as there is an increased degree or exacerbation of inflammatory symptoms, until it is subdued; local bloodletting by leeches and cupping should be persevered in as long as any degree of pain remains, and of the two topical means, I think most benefit has been derived from the application of leeches on each side of the spinous processes, because they also produce some cutaneous inflammation. The bowels should be acted upon from three, to six or seven times a day, by neutral salts and antimonials, as long as pain and fever continue. Perspiration should be freely excited by these remedies, warm diluents, and the warm or vapour bath. Blisters should be applied along the whole length of the affected or painful portions of spine on each side; low diet should be observed, and if the symptoms linger, mercury should be exhibited so as to excite slight salivation, by which, obstinate inflammation is frequently superseded. The patient should be kept quiet, and confined as much as possible to the recumbent posture. As the disease sometimes steals on insidiously, and the degree of mischief or injury induced cannot be always ascertained by the state of the symptoms present, it is recommended to use the active and powerful remedies in the early stages of disease, with proper discretion, without resorting to excessive depletion. In a case of violent inflammation of the medulla spinalis combined with tetanus, related by Professor Brera, one hundred and twenty leeches were applied at once along the whole course of the spine; the muscles became relaxed, but the young man died. This was bold practice; but the quantity of blood extracted must have been very great, and if the usual computation of the quantity of blood drawn by a leech, estimated at two ounces, were correct, fifteen pints of blood would have been taken away, which is more than half of the blood circulated in the body; if a leech only extract half the computed quantity, it would still be seven pints and a half.

The remedies enumerated should be persevered in as long as any symptom of inflammation remains, but if the disease become of long duration, it will belong to the chronic form of inflammation.

Chronic inflammation of the medulla spinalis is sometimes consecutive to an acute attack, and this is the modification most consonant with the definitions of nosologists. Dr. Abercrombie has also considered those cases to be chronic, whose progress is slow, and which are of considerable duration.*

In chronic inflammation, pain is still felt in some portion of the vertebral column, especially on pressure or after exercise, in which the arms have been employed, but the pain is rarely accompanied with fever; a sense of lassitude and muscular debility prevails, with a nervous, low, and irritable state of mind; in this as in active inflammation, the patient finds lying on the back the most easy position, but when lying, he is frequently unable to move or raise himself up without assistance; one of the extremities may continue to be affected with chorea, and some of the flexors of the fingers and thumb may be affected with permanent contraction. The appetite is impaired, and the bowels, in general, costive. The head is subject to occasional pains almost every day. The spinal pain sometimes extends to or darts through the mediastinum to the sternum, or from the loins to the abdominal contents. Dyspnœa is frequently induced by very slight exertion. Should this form of disease not be subdued, the inflammation terminates in suppuration or in the effusion of a serous or sanious fluid in the spinal cord, and the worst symptoms of acute inflammation are produced, as paralysis or convulsions of various muscles, epilepsy, coma, loss of speech and memory, followed by death, which often ensues rather unexpectedly.

In the chronic form of disease, I have generally directed topical bleeding by leeches or cupping, twice a week, with occasional blisters, and have prescribed an alterative dose of mercury every night, and a hydragogue aperient every morning, and, where the disease has not yielded, I have excited some degree of ptyalism with the happiest effects. I have occasionally used perpetual blisters, but have, in general, preferred the successive application of them.

The regimen should be antiphlogistic, and the body kept at rest as much as possible. By these means, a recovery may be frequently effected. In one case that I had cured, the patient was carried off on the following year, by phrenitis. I have known the chronic form of disease to return every year, in a milder form, and I have known the irregular action of the muscles of one lower extremity, resembling chorea, to continue long after all pain and spinal inflammation had been subdued.

The chronic and acute forms of disease are sometimes followed by lassitude and muscular debility, of considerable duration, for which chalybeates and rhubarb aperients have been highly beneficial.

It has been mentioned, that inflammation of the spinal cord

* Edinburgh Journal, January, 1818.

may terminate in permanent thickening of its membranes, which may be followed by their induration. In such cases, it may be supposed, that the increased vascularity and thickening arising from active inflammation, may be kept up, and even augmented, by an ensuing chronic inflammation; and should this continue, the membrane may be changed to a state of cartilaginous hardness, such as is observed in the changes produced by inflammation in other membranes, in which a series of changes takes place from a membrane in its natural state, through the progressive stages of inflammation, thickening, induration like cartilage, and ossification.

Hence it is, that some rare cases have been recorded, which disclose these several conditions of the medulla and its membranes. The well-known case of the Count de Lordat, by Dr. Maty, which has been copied from the London Medical Observations and Enquiries, vol. iii., p. 257, into almost every work subsequently written on spinal diseases, is an instance of long suffering and death being occasioned by a thickening of the membranes, pressing on the medulla, and producing a callous state of it. In this instance, the symptoms resembled those of chronic inflammation, from which it could not be distinguished. He died suddenly, four years after the accident.

Mons. Portal has published the Marquis de Causan's case,* in which the part of the spinal cord included in the cervical vertebræ became of the hardness and consistence of cartilage, and the membranes appeared red and inflamed. The brain and all the viscera were sound. The symptoms resembling those arising from pressure on the brain, by which the organs of sense, and the power of the muscles were gradually abolished.

Dr. Esquirol found the external surface of the theca vertebralis covered, through its whole extent, with osseous scales, from one line to two lines in diameter, in a woman who had been subject to epilepsy for five years, and who died in one of the fits. *Bulletin de Faculté de Médecine de Paris. Tom. v.*

Besides the changes which are the result of inflammation, dissection has disclosed new organizations in the spinal canal, and exposed to our contemplation, hydatids, and two kinds of tumours, one as hard as scirrhus, and the other as soft as the fungus in hernia cerebri. The appearance of hyatids is mentioned by Franck, Portal, and Dr. Esquirol.

In a case given by the latter, tom. v., p. 424, a woman, 53 years of age, became subject to epilepsy, after a fright. The fits became periodical every second or third day, during three years, and were severe. After one of them, coma was induced, and five days after, she expired. Hydatids of different sizes were discovered within the theca, in its whole length. There is no diagnosis by which such cases can be distinguished.

In the Apiarium of Harderus, p. 236, there is a case of a schir-

* Cours d'Anatomie Médicale, tome iv., p. 116.

rhous tumour of the size of a nutmeg found in the spinal canal of a young woman. Three similar ones were found in the cerebellum. When they were cut into, a yellow pus was pressed out. The patient died of violent convulsions. There is no diagnostic of this modification of disease.

In the *New London Medical Journal*, and in the *Medical Observations*, vol. iii., are two cases recorded of soft tumours appearing on the back, which took their origin, and issued from the spinal canal. In both cases, paraplegia and paralysis of the pelvic viscera ensued, and the patients died. The appearance of the tumours attached to the spine is a sufficient diagnosis of this kind of malady, when connected with symptoms of pressure on the spinal cord.

Cases in which the spinal marrow has been found softened or destroyed, have been alluded to; and more will be found in Dr. Ollivier's work.

CASES.

CASE 1. Miss Bruce, æt. 23, now residing in Beaufort Buildings, Strand, in the spring of 1818, was bruised on the occiput, by having her head pressed hard against a table, and, two days afterwards, fell down stairs, and hurt the spine; severe headache and fever supervened, for which I bled her freely, and ordered purgatives and febrifuge aperient medicine. On the same day that venesection was employed, and the pain in the head had abated by the remedies administered, a severe pain seized the back between the scapulæ, which appeared to spread from thence all over her body, and rendered her unable to lift or move her arms without great pain, or move her lower extremities; the spine is in no-wise distorted: the fever continued, with anorexia, thirst, and furred tongue; the bowels were obstinately costive; the pain of the back was very severe on pressure being made on the spinous processes, and although the pain appeared to be within the bone, all the outer layer of dorsal muscles were affected with pain. She was easiest when lying on the back, but she could not then move her arms to assist herself, and even when up, she could not lift her arms to her head; in being raised in bed, although the whole body was moved at once, she experienced great pain in the head and back from the movement. "Every motion of the back is agony," she often said. She was bled, leeches were applied to the occiput, and painful portion of the dorsal vertebræ, followed by blisters; a strict antiphlogistic regimen was observed; the bowels were kept active by neutral salts and calomel, which also allayed the fever. By these means, the acuteness of the inflammation was subdued, and the occipital pain almost entirely relieved. The blisters on the occiput, she thought, were the most beneficial, and always removed the pain there; but the pain in the dorsal portion of the spine continued a long time, in a greater or less degree, and,

as long as it remained, the muscular debility of the extremities continued, so that she could not walk a mile, from May to December. She is a dress-maker, and used to work lying on her back; walking occasioned great frequency of pulse, and she soon became tired, affected with lassitude and sinking, and was out of breath; her head and back were sometimes jarred with pain, that also shot from the back through the mediastinum to the sternum. The inflammation was finally removed, by a most tenacious perseverance in the use of leeches, blisters, successive and perpetual, mercury, purgatives, and antiphlogistic regimen.

The appetite was always bad. The successive blisters gave more relief to the dorsal pain than leeches. In the early stage of the complaint, *fotus papaveris* was twice applied to the back, and although it appeared to give ease, she felt sickness and syncope the same as she had done after bleeding. She fainted away each time, and it was discontinued. She has had a regular return of pain of the back and head, with similar symptoms, in a milder degree, in the spring of every year since; which has been removed by topical bleeding, blisters, purgatives, and the antiphlogistic regimen. The muscular debility remaining after the pain has subsided, yielded more readily this year than any other to the use of *Tr. ferri muriatis*, and occasional aperients.

CASE 2. Mrs. Phillips,* *æt.* 37, October 1st, 1818, had been labouring under a complaint of the spine for several weeks, and, as it was treated as a nervous affection, she derived no benefit from the medical treatment, and, on changing her medical adviser on this account, she applied to me. She complained of severe pain in the dorsal portion of the spine, which shot through the chest to the sternum, and which was increased on pressing on the spinous processes, and on moving the arms; the upper and lower extremities, at times, seemed powerless, and when she went to bed, and assumed the recumbent posture, she lay like a paralytic person, and was unable to move or raise herself up; and, of course, had infinitely less power of muscular motion than when sitting up; in the horizontal position, the pain extending from the spine to the sternum was more severe, and sometimes impeded free respiration; fever, with thirst and anorexia, was induced; the pulse was generally more than a hundred, the face flushed, and the patient was almost always in a state of free perspiration; the bowels were obstinately costive, and the patient was affected with headache, and was nervous and irritable. She was bled from the arm, and leeches were applied to the dorsal portion of the spine affected with most pain; she took calomel and gamboge at bed-time, and two hydragogue aperient draughts in the course of the following forenoon. The antiphlogistic regimen was strictly observed.

Oct. 2d. The patient past last night much freer from pain than

* No. 7, Upper Charlotte Street, Fitzroy Square.

she had done for many weeks, and was able to move a little in bed, the symptoms continued, however in an abated degree, and the leeches were repeated on the 5th and 8th with increased good effect, whilst the bowels were made to act three or four times a day, by the medicines already mentioned. The leeches were once more applied, and venesection was again had recourse to. Blisters were laid on the spine, and the calomel was continued until slight ptialism was induced. By these means, the acute pain and inflammation, and its attendant fever were removed, and after the 23d of November, the pain was seldom felt in the spine, and the muscles of the extremities and back gradually recovered their due share of strength, and the patient's health was restored. Stimulating liniments were rubbed on the spine, after the pain became only occasional. The patient required the use of purgatives to assist the action of the bowels, until after the 3d of December. She has not had any return of the symptoms. I have seen three cases similar to Mrs. Phillips's, two of which recovered, and one died; the latter I only saw once, at which time she was bled with good effect, but as her medical relation and herself did not think her case so serious as I did, and she objected to topical bleeding and a regular course of medicine and low regimen, my attendance was withdrawn, and she died rather unexpectedly by her friends, in less than four months.

CASE 3. Harriet Blundell, æt. 19, Covent Garden Infirmary, states, she had been affected with gonorrhœa for many weeks, which did not yield to the usual remedies, but in the beginning of December was suppressed rather suddenly by an alum injection. *Dec. 10.* She complains of most severe, constant pain, extending from the basis of the head along the spine as low down as the 9th dorsal vertebra, and of pains shooting from the occiput to the left parietal bone; the left shoulder and the neck in its whole circumference are painful; she lies on her back, inclining obliquely to the right side; the arms weak and almost paralytic, and she can scarcely move herself at all; pains shoot into the breasts, and an obtuse pain is felt under the sternum; pyrexia is considerable and attended with pervigilium; temporary delirium; anorexia; thirst; tendency to constipation. She was bled *ad deliquium*, and ordered a drachm of magn. sulphas, with antimony and colchicum, every six hours. The symptoms remained stationary, or were somewhat abated, but no permanent amendment ensued from the 10th to the 17th, yet the symptoms had varied. *Dec. 17.* The pain of the head is now greater than the pain of the spine, and is most felt around the crown of the head; for the last three days she has lost all muscular power, and could not move her arms or her body; she complains of great pain in her breasts and lower extremities. She states that the severity of pain alternates between the head and spine; and when the back is very painful, the head is much relieved, and *vice versa*; the fever, with great fre-

quency of pulse, varying from 120 to 150, pervigilium, occasional delirium, utter loss of appetite, and thirst continue; she frequently cries; is very low, and sighs; the bowels are kept open, and she sometimes perspires freely — Rep. venæsectio et mist. feb. and she was prescribed a grain of calomel and five of jalap every night.

Dec. 19. Is much the same; she complains of pain of her throat and some difficulty of swallowing, but no mark of internal inflammation is visible; pressure on the spine increases the pain very little, and fomentation gives temporary relief; bowels are kept relaxed — Rep. venæsectio et appl. hirud. viii. inter scapulas.

Dec. 28. The symptoms and pain have not been so severe, but the spinal pain and headache have continued more or less, with fever, frequent pulse, loss of appetite, and extraordinary watchfulness, so that, in fact, she has hardly ever slept at all, and her sufferings excite the commiseration of her nurse and attendants; I thought it possible the state of the pulse and pervigilium might arise from nervous irritation, and tried to induce sleep with a pill of opii, gr. i., et hydr. submur., gr. v. h. s. s., but it failed; and on the following day, the headache and spinal pain had increased and she was again bled *ad deliquium*. The blood has always exhibited the coriaceous buff. She has been bled with leeches on the spine since the 28th. The bowels are very inactive, and she takes magn. sulpt. ʒiiss. cum liq. ant. tart. ʒss. &c. 6^{is} horis.

Jan. 4. The symptoms have abated since the last bleeding, but the disease has periods of remission and exacerbation, and she always suffers most in the night; the pain of the spine from the occiput to the 9th dorsal vertebra was more constant and acute than the headache; the greatest pain has always been about the 4th dorsal vertebra; the spinal muscles have not been contracted as in opisthotonos, but were rigid from the constant immobility of the spine in consequence of the pain its motion produced. Until the 27th, the symptoms had been moderated, although a chronic form of inflammation was present, which was treated by local bleeding, leeches, the purgative saline draughts, and I also prescribed pil. hydr. gr. v. ter quaterve die. On the 27th, there was a severe exacerbation of symptoms; the spinal pain and headache were nearly as severe as ever, and all the symptoms described on the 17th Dec. returned. At her own request, she was bled largely and fainted. Syncope returned at intervals for several hours, with languid circulation, cold extremities, pale lips, &c., and it was necessary to give her warm diluents and stimulants to remove this state of collapse, after which, the antiphlogistic treatment was resumed, with the use of the pil. hydr. *Jan. 31.* Is better; the pain of the head and back is slight; the pulse is quick, and fever, with anorexia, thirst, and pervigilium continue in an abated degree. From this period, the symptoms abated gradually, the pains diminished, the fever and quickness of pulse subsided, the power of volition and the muscular movements were resumed without producing pain after a time; but the symptoms had been so pertinacious, that they ap-

peared at last to disappear abruptly, especially some degree of headache and pain about the 4th dorsal vertebra, which finally left her on the 8th of March. From Feb. 1st to the last named period, she continued the use of pil. hydr. gr. v. 6^{is} horis, with saline aperients daily; and leeches or a blister were applied to a portion of the spine between the occiput and 9th dorsal vertebra once a week, until a permanent blister was established about the 4th dorsal vertebra. She continued pil. hydr. gr. v. et aloës gr. i. bis die, for some time afterwards. It is remarkable, that the salivary glands were not in the least affected even by pil. hydr. gr. xx. every day for seven weeks, and gr. v. twice a day afterwards. Mercury was prescribed with a view of removing chronic inflammation. There were some other remarkable features in this case. The pulse was generally from 120 to 150. The bowels throughout were disposed to confinement, so that six drachms of magn. sulph. a day, combined with colchicum and antimony, and a calomel and jalap pill every night, hardly ever produced more than one evacuation a day, and sometimes not that. There was such an utter loss of appetite the whole time, that, for the first five weeks, she lived on toast and water and tea, and yet the fever and frequency of pulse continued. For the same period, she had hardly one hour's sleep in the 24, and yet she laid still and was not restless, because the muscles were unequal to action, and compulsive action produced pain, but there did not appear to be any fixed spasmodic contraction of the spinal or other muscles, such as occurs in tetanus. The speedy return of the gonorrhœa with a copious discharge and regular menstruation did not produce any evident and decided relief. The respiration was not much disordered, but there was frequently pain and a sense of suffocation about the throat with difficult deglutition, so as to lead to a frequent examination of the fauces to detect disease. A very long observance of the strictest antiphlogistic regimen and extensive depletion did not cure the gonorrhœa, which continued a month after spinal inflammation terminated. The patient has since been in the Magdalen Hospital and has enjoyed good health.

CHAPTER XIV.

SOME OTHER AFFECTIONS OF THE SPINE, AND DISEASES SAID TO ORIGINATE IN ITS DERANGEMENT.

SECT. I. — *Various Extravasations of the Spinal Canal and Cord.*

IN some recent works on spinal diseases, a distinct chapter has been allotted to the consideration of the various effusions of blood

(whether fluid or clotted) and serum, and of even the gaseous exhalations that have been found on dissection in the spinal canal or between its membranes. But as the adoption of such an example would lead to much unnecessary repetition; as the effusions are generally, if not always, the consequences of the various lesions and diseases that have been treated of, particularly of spinal inflammation, of carious vertebræ, fractures, subluxations, concussions and wounds of the spine; and as, from this circumstance, they must be strictly regarded rather as symptoms or effects than idiopathic diseases, and, moreover, as no one has attempted to establish a diagnosis of the various spinal extravasations; I have ventured to omit a distinct consideration of them, and leave them to be viewed as symptomatic accompaniments of other spinal complaints. In this arrangement I am supported by analogy, for no nosologist or author has attempted to establish similar extravasations within the cranium, as idiopathic diseases, but they are universally viewed as symptoms or consequences of cerebral or arachnoid inflammation, concussion, fracture, and apoplexy.

SECT. I. — *Some Conjectures.*

Dr. Abercrombie has concluded an excellent paper on spinal complaints in the *Edinburgh Med. and Phys. Journal*, for January, 1818, by enumerating conjectures that have been made of the influence of the spinal cord and membranes in producing various diseases. Thus, Hoffman, Ludwig, Lieutaud, Burserius, Ferneus, Bilfingerius, and Portal, attribute many spasmodic and nervous diseases to irritation or slight pressure of the spinal marrow and membranes. M. Esquirol found the spinal cord affected in various ways in fifteen cases of epilepsy.

Bonetus, and Privatus as quoted by Sauvage, relate a case each of colica pictonum, in which the spinal marrow was supposed to be affected. In Bonetus's case, there was much serous effusion under the spinal membranes. In many cases of fever inflammation and effusions of serum and pus have been found in the spinal canal after death, and, hence, all constant pains in the course of the spine should be attentively considered, and treated as local inflammations, if the other symptoms admit of it. This appearance after fever may be familiar to many who examine the spinal canal in their dissections.

Hydrophobia has been sometimes attended with spinal inflammation. See *Medico-Chirurgical Journal and Review*, for Oct. 1817.

Dyspnœa. — Frank thinks many cases of this disease depend upon some derangement of the spinal cord, and, as dyspnœa is a constant symptom of three species of spinal distortion out of four, no one will doubt it.

APPENDIX.

CASES OF EXCURVATION.*

CASE 1. — Miss Jane Archer, æt. seven (56, Wild Street), born of parents free from scrofula. Her father is subject to asthma. She is of a thin and delicate form, but has no strumous appearance. She has been affected with excurvation of the dorsal vertebræ, during the last five years and a half, which has gradually formed, but has increased very much since Christmas last to this period (May 29th), which rapid increase is attributed by the parents to another fall she received at that time, but is really owing to the principle mentioned at p. 56. The curvature embraces the twelve dorsal vertebræ, and forms a regular arc, whose cord line measures only four inches, three and a half lines!* The spine, of course, forms a hump projecting behind, the scapulæ appear to be placed on the sides, the ribs are “flattened on their sides,” that is, they do not describe their usual curve, and are elongated; the sternum projects, and is much raised and depressed by respiration. The lower portion of the second division of the sternum projects to a point, and the cartilagio-ensiformis is turned inwards, so that the whole sternum presents the form of a broken bow, as if broken at the point of union of the second division of the sternum with the zyphoid cartilage. She has not been entirely paralytic, but has been very weak, and unable to walk without placing her hands on her knees to support her body, and remove the weight from the spinal column. Her parents informed me, her muscular strength was much restored by the use of the vapour-bath three times a week. She is still weak and thin, and her rest is interrupted by a pain about the posterior superior spinous process of the ileum. She is affected with dyspnœa and cough, and once suffered an attack of asthma. Her digestive organs perform their functions well, and she has no tightness or stricture across the epigastrium, usual in excurvations. On May 29th, 1822, after extending the spine, and pressing gently on the projection, the compress, pad, and bandage were applied around the chest, without a shield, and the bandage was fixed by shoulder straps. The apparatus and extension were renewed every other day. Extension

* The natural length of the twelve dorsal vertebræ in a girl of her age should be about seven or eight inches; it was hence very probable that some of the bodies of the vertebræ were wholly destroyed, and that a perfect recovery could not be obtained.

was frequently employed by the parents. The patient observed the facial horizontal position.

June 2d. The measurement of the different derangements of the chest and spine was taken. The greatest projection of the central spinous process of the distorted dorsal vertebræ beyond the spinal line of the lumbar, is three inches. The greatest projection of the same process beyond the spinal line of the last cervical, is one inch, nine lines. The whole of the dorsal vertebræ constitute the segment of a circle, nearly equal to a semi-circle. The projection of the most protruding dorsal vertebra beyond the twelfth, is two and a half inches. The breadth of the chest, from side to side, is six inches. Depth of the chest, from the extreme sternal projection to the extreme dorsal, is eight and a half inches. Length of the body is three feet two inches. The head falls in between the shoulders.

June 4th. — Three spinous processes are nearly reduced to a straight line, and the sternum projects less. Used the vapour-bath.

June 9th. — Four spinous processes nearly reduced to a level. Measured again. The greatest projection of the dorsal vertebræ beyond the axis or spinal line of the lumbar, two inches one quarter. The greatest projection of the same beyond the twelfth dorsal, is one inch seven lines. Breadth of the chest is six and a half inches. Depth of the chest, seven and a half inches. She derives much support from the apparatus, and feels as "if she were going to pieces" when they are taken off for a short time.

June 15th. — The general health has been good, and the patient went into the country for a few days.

June 29th. — The general health is still good. Four spinous processes are on a level. The greatest projection of the dorsal vertebræ beyond the spinal line of the lumbar, is reduced to one inch seven lines. The greatest projection of the same beyond the spinal line of the seventh cervical, is only one inch five lines. Breadth of chest, seven inches one line. Depth of chest, seven inches five lines. Length of body, three feet two and a half inches.

July 15th. — The general health is still good, although she has slight dyspnœa. The greatest projection of the dorsal vertebræ beyond the spinal line of the first lumbar, is one inch two and a half lines. The greatest projection of the same beyond the spinal line of the seventh cervical, is one inch five lines. Depth of chest, seven inches three lines; breadth, seven inches. Length of body, three feet three inches, which was not increased during her life.

August 4th. — The spinous processes of the eleventh and twelfth dorsal vertebræ have regained their natural situation. The greatest projection of the most prominent spinous process beyond that of the twelfth dorsal is one inch. The greatest projection of the same beyond the spinal line of the seventh cervical, is one inch three lines.

August 31st. — The greatest projection of the most prominent spinous processes of the dorsal vertebræ, beyond that of the eleventh, now in situ, only seven lines. The greatest projection beyond that of the seventh cervical, one inch five lines. The length of the cord line of the arc, including the eleventh and twelfth dorsal, is now five inches one quarter. Depth of chest, seven inches; breadth of chest, seven inches five lines.

During this period, the sternum and anterior part of the chest had, in a great degree, recovered their natural shape, and the patient was no longer chicken-breasted. The ribs on the sides were also much more curved. The pain on the posterior part of the ilium soon disappeared, and did not return. The general health was very good, and she had improved in every respect, agreeably to the testimony of all. She paid a visit of some days to the country; and on her return, at the end of September, she was seized with a most untractable attack of asthma, of which she died early in October. Her father, who has since died of asthma, had firmness and philosophy enough to allow an examination after death, which presented the following appearances:

The muscles of the back appeared to be stretched where they passed around the greatest convexity of the excurvation, and their volume in this situation was much diminished. The interspinous ligaments were tense. We took the liberty of sawing out, and bringing away the greatest portion of the spine, with parts of the posterior ends of the ribs attached to it. On removing the spine, the lungs presented a mass more like dark coagulated blood, than the parenchyma of the lungs, so much were they gorged. They adhered pretty generally to the costal pleura. The bodies of the 7th, 8th, 9th, 10th and 11th dorsal vertebræ, were entirely removed by absorption, and the superior and anterior portions of the body of the 12th dorsal were also absorbed; while their processes remained, although altered in structure, and curved. The spinous processes of the 7th, 8th, 9th, 10th and 11th are united by ankylosis. The posterior ends of the ribs are close to each other, and are attached to the anterior part of the transverse processes. The inferior part of the 7th rib is partly destroyed by the absorbents. The ligamentum anticum commune is in the same tense state as in health, except where the bodies of the vertebræ are destroyed; in this situation it is thickened and loose, and covers a small atheromatous tumour, which it surprised us to find thus situated. Nature had begun to deposit ossific matter on the vertebral side of this ligament, and it was covered with fat towards the abdomen. The engraving will convey some idea of the curvature* of the ten dorsal vertebra removed; the extent of the outer line of curve being four inches seven lines; of the inner line, one inch three lines. The

* While living, the muscles prevented the upper dorsal vertebræ from inclining so much forwards. — See *Med. and Phys. Journ.* for March, 1823, for the engraving.

distance between the 6th dorsal vertebra and the remains of the 12th dorsal, is only four lines!

The spinal canal and vertebræ were sawn through, in the presence of my friend, Mr. Copland Hutchinson, and a professor of surgery from Berlin. The spinal canal and medulla canalis were preserved continuous, although both, in some parts, had their natural dimensions diminished, and both deviated from the natural spinal course, by being forced to take a circuitous one around the curvature. The spinal marrow and its membranes were merely covered by the spinous processes, where the excuvation is most prominent and convex. These processes do not form a thick defence, as, in one or two parts, they are not perfectly ankylosed, or united by bone. The diameter of the spinal canal in the dorsal vertebræ above where it is contracted, is six lines. The diameter, in its narrowest or contracted part, is four lines. The diameter of the canal in the lumbar vertebræ, below the contracted part, is seven lines. The foramina for the passage of the nerves remain entire, although some appear diminished in size. On examining the bodies of the vertebræ, after they were divided by the saw, we all agreed there was not the slightest appearance of caries, and that the bodies of the vertebræ had, in all probability, been destroyed by progressive absorption.—This specimen of diseased spine will be found in Mr. Brooke's museum.

CASE 2.—Miss Downes, 72, Long Acre. February 25th, 1822, has been affected with excuvation of eight dorsal vertebræ twelve months; of which she was six months under Mr. Cline's experienced treatment, and six months under another able surgeon, whose name Mrs. D. declined to mention. During this time, she had been confined to the dorsal horizontal position on an inclined plane of wood covered only with green baize, with a socket to receive the head, and to this her recovery has been principally trusted; except that, latterly, the mother has been directed to press on each side of the spinous processes with a wooden instrument, similar to what is described by Dr. E. Harrison, in the Med. and Phys. Journal, for May, 1824, p. 354. The excuvation projected between the scapula an inch and a half beyond the spinal line; the scapula were thrown on the sides; the sternum protruded anteriorly, so that the long diameter of the chest was from the vertebræ to the sternum, and she was chicken-chested; there was no pain of the spine on pressure; the respiration was difficult and hurried; there was complete paralysis of the lower extremities; violent pains across the epigastre were sometimes felt, at other times she felt a corded tightness there; the digestive functions were imperfect; the bowels costive and stools muddy; the urine scanty and turbid, and full of a branny or lateritious sediment; she was languid, pale, and emaciated. A pill of rhubarb, pil. hydr. and pulv. ipecac. was prescribed every night, and a mixture of magn. sulph. and magn. carb. with aq. menth. pip. was taken in such divided doses as procured regular evacuations from the bowels every day. Extension and

pressure on the curvature were simultaneously employed every other day, for an hour, under my superintendence. Friction was used every day, and extension was used whenever it was convenient to the mother, for a short time. The shield, pad, and bandage were employed. The extremities were rubbed and artificially exercised. The facial horizontal position was constantly observed. In a fortnight, there was considerable improvement, and the patient began to feel those singular pains in the extremities which precede the return of their muscular power. In three weeks, she could move her lower limbs; her general health was much improved; the bowels were regulated and the stools were of a more yellow colour; the urine was clearer and more abundant. The excurvation gradually diminished. The lower vertebræ implicated, were restored to the spinal line by the 22d of May, but the two upper were not. At the above period, the general health was as good as could be; she had become plump and ruddy, and had the free use of all her muscles, and so delighted was her mother to see her walk and run about, that she was contented with an imperfect cure of the spine, and requested me to discontinue my attendance on the day last mentioned, when some distortion and dyspnœa remained and I suppose will ever continue.

Oct. 8th, 1824. — I had not seen this patient for two years, and on calling on her to-day, I was informed by her mother, she had wholly discontinued all my plan of treatment since I took my leave, and had trusted her further amendment to the application of a back-board, without a rod to support the head. The consequence is, the excurvation is nearly as great as ever, and she is chicken-chested; but she is not paralytic, and she has no complaint but dyspnœa. This result should reconcile parents to perseverance.

CASE 3. A. Peckman, æt. five, 1, Brown Street, Bryanstone Square, on the 7th of March, was admitted a patient of the Marylebone station, of the Royal Metropolitan Infirmary for Diseases of Children. He had, for some months, been gradually declining in strength, more particularly in the back. He soon became fatigued; and from inability to walk upright, he was generally induced to sustain his body, in his movements about the room, by placing his hands on the chairs, tables, &c., that stood in his way. He complained of pain and tightness across the epigastric region. His bowels were regular. One examining the spine, a slight projection of the spinous processes of the fourth, fifth, sixth, and seventh dorsal vertebræ, and of the two upper lumbar, was observable, which, however, scarcely deviated from the spinal line; and, on laying the patient in the facial horizontal position on a feather bed, and pressing with a gentle mechanical force on the projecting processes, they were, to all appearance, replaced in their natural situation, and the pressure occasioned very little pain. In this incipient state of distortion, no perfect arc is yet formed, but the existing derangement may be recognized by the spinous processes stretching the skin over them, and making it appear white and shining, re-

sembling the phenomenon of the stretched skin over the knuckles of a clenched fist. A compress, pad, shield, and bandage, were applied, and the facial horizontal position enjoined.

The patient continued under this plan of treatment three weeks, and had evidently improved in strength, and in the appearances of the back, when he was infected by measles, the febrile stage of which was extremely severe, and induced very great general debility, of which the dorsal muscles partook. As the mechanical management of the spine had been laid aside during the measles, and as the patient had been subsequently allowed to sit up, and follow the bent of his inclination in his movements, with a view of restoring his general health, the spinous processes were soon projected more than when first seen, and he was again confined to the treatment commenced and employed before the attack.

Of the confinement to bed, indispensable to our plan of treatment, and founded on the principles by which it is conducted, most children are impatient, and of its propriety many parents cannot be made sensible; both of which circumstances occurred in the present case, and after the boy had submitted again to the practice about a fortnight, we found him, sitting on the staircase, and inquired how he came there? "Oh! (said his mother to Mr. Seynage and me), his father did not like his confinement, so we took further advice. We carried him to Dr. Latham (sen.), who told us to take off his apparatus, and that confining him to bed would make him more rickety than he was; therefore, said the Doctor, let him run about, and send him to the country for six months, where he will get strong and hearty, and the back will not become crooked." As Dr. L. had written on the subject of curved spine, in the year 1793,* and had this "goodly seeming" of having directed his attention to the subject; the opinion of this experienced physician occasioned us to doubt the correctness of our own, and to imagine that this case possibly might not be an incipient one of curved spine; although our experience and observation had induced us to conclude that it was so, and to treat it as such.

The boy was sent to Hammersmith, in June, and the repeated accounts received from the lady who recommended him to our care, informed us that the excurvation of the spine was gradually increasing, and, in spite of country-air and exercise, the local complaint had increased, and the constitutional health had suffered much. He returned home at Christmas; and, in April, I was again requested to visit him, at 26, Seymour Place. He was much thinner, and very weak; his appetite was bad; the pain across the epigastric continued; and the double curvature of the vertebræ was completely established, of which variety he indeed exhibited a good specimen. The chest now assumed an oval form; eight of the dorsal vertebræ formed a curve that projected backwards be-

* See a Letter of Dr. L.'s in Sir James Earle's Observations on the Curved Spine.

tween the scapulæ, which were thus thrown in a lateral situation; the sternum projected forwards; the ends of the ribs were drawn out both behind and before, and the chest assumes an oval form; the cartilages of the false ribs advanced into the epigastrium, and approximated so near that the opposite sides almost touched. The sternum inclines to the right side, and appears twisted. He could only walk in the bent posture, and not any length of time without experiencing fatigue, and stopping to take rest. His bowels were regular. He had always an eruption of sores on the skin. An offer was now made to undertake the treatment, provided the objectionable horizontal position would be considered a *sine qua non*, and be submitted to. On the next visit, we were informed that an oilman, of the name of Riches, at Westminster, promised to effect a cure by plasters and the steam-bath, without enjoining a recumbent posture, and our services were withdrawn. Riches's quackery was discovered in three weeks; and, in May, the child was carried to Mr. J. Brooks, who urged the propriety of a recumbent posture, and ordered some purgative, that has brought away some black fæces, and improved the general health. On the 17th of June, being again requested to visit the child, it was found that a lateral curvature was added to the other deformities, and the patient was very much emaciated. The boy now began to submit to the facial horizontal posture, and to improve.

July 3d. — The patient has been more observant of the facial horizontal posture than had been anticipated; the pad, shield, and broad bandage have been worn; extension, friction, and pressure on the excursions were daily employed; he is still thin and weak; his respiration is easier and freer, and his general health has generally improved; the lower lumbar excursion and lateral curvature are already removed, and the upper excursion, formed by nine dorsal vertebræ, falls a little into the spinal line. The patient had been ordered a rhubarb purgative twice or thrice a week and some *vin. ferri*. He had been subject to great pain of the epigastre and screaming at night, before the use of purgatives and the other means of recovery had been employed; but these have entirely left him. The utmost projection of the curve was at the spinous process of the 6th dorsal vertebra, and a quarter of an inch beyond the 1st lumbar and 7th cervical vertebræ in their natural situations. The cord line of the nine dorsal vertebræ forming the curvature, from the 2d to the 10th inclusive, measured only four inches and a quarter.

From this period, the general health improved, and the parents soon allowed the boy to leave off his medicine; in a short time afterwards, they became inattentive to all the other means of treatment, except the use of the bandage and pad. He went into the country at the end of September, when there was still a considerable degree of excursion remaining, but with a fair share of general health, and I have not since heard of him.

This case exemplifies the uninterrupted progress of the disease,

arising from muscular debility; proves the necessity of professional assistance in the earliest stage; and shows that country air and exercise, without recumbent position and mechanical means, are of little avail in arresting the progress of spinal curvature, which, in this case, might have undoubtedly been prevented by the means originally recommended. It also shows how readily a relapse or increase of curvature follows any acute disease, that induces general debility. Cases of excurvation from the muscular debility induced during dentition, and from the native debility of infants, are too common to require particular exemplification.

CASES OF ANGULAR PROJECTION.

CASE 1. — Frances Parker, æt. four years, nine months, born of healthy parents, and one of six children, neither of whom presented the features of a scrofulous constitution, residing at No. 3, Slade's Place, Blandford Street, had been affected with the angular projection of the spine two years, when she was admitted a patient of the Marylebone station of the Royal Metropolitan Infirmary. The projection had been formed in a gradual manner, one spinous process only having been first observed to protrude outwards: and, as this projection enlarged and increased, it became evident that other vertebræ above it, in the progressive course of time, were drawn out also. The projection comprehends three lower dorsal and four upper lumbar vertebræ. When the patient stands erect, the projection of the spinous process of the fourth lumbar vertebra is so much beyond that of the fifth, that it appears as if, at this point, the upper part of the spinal column were about to fall off from the part below it. From the spinous process of the ninth dorsal vertebra, which occupies its natural situation, the spinous processes of the seven vertebræ below it gradually incline outwards, till the line reaches the extremity of the spinous process of the fourth lumbar vertebra, which becomes the angular point, the base line of the triangle being formed by the lower surface of this vertebra. Between the spinous processes of the fourth and fifth lumbar vertebræ, there is a space in which the fore-finger may easily be pressed upon the interspinous ligament now elongated, although, when *in situ*, they nearly approximate. The transverse processes of three lumbar vertebræ are distinctly felt projecting on each side of the spinous processes, and, instead of these processes falling gracefully in between the muscles of the back, they elevate and stretch the integuments and muscles, so as to form a bow or arc laterally, the cord line of which is formed by transverse processes, on which it may be imagined, the spinous process is raised as a perpendicular, dividing the arc into two equal parts. When the patient walked, which she could only do for a short time in a waddling gait, she evinced great weakness of the muscles of the back, and of the muscles generally, for she always stooped

forwards, and supported herself by placing both hands on her knees, so that the nates projected behind; the foot of the right leg bent inwards, and the flexor tendons of the same leg were contracted. In the attempts to walk she frequently fell down, or, from severe pains of the back, was obliged to lie down, even in the streets. The pains of the back, and of both knees (particularly of the right), sometimes made her scream, and often disturbed and prevented sleep. Any sudden motion of the vertebræ induced smart pains of the back; dyspnœa ensued from very slight exertions; the appetite was bad, and the body weak and emaciated. The patient had submitted to various plans of treatment, suggested by different professional advisers, and from January, 1821, had been subjected to the dorsal horizontal position, and the successive application of blisters, which, without producing any benefit, or checking the progress of the complaint, had ulcerated the skin so extensively, and produced such large crops of phlyzacious pustules, that on my first visit, in May, I declined the case until the eruptions had ceased, and the ulcers had healed.

On the 22d of September, 1821, the treatment commenced. The patient was laid on two pillows in the facial horizontal position; the pillows were separated at a little distance, opposite to the projecting vertebræ; the body was then extended, and the spinous processes gently pressed inwards; a compress, pad, and shield, were then applied over the projecting vertebræ, and retained there by a long bandage. Her mother was enjoined to confine her to the position above-mentioned. In the night, however, she turned on her back, and a crust of bread having been accidentally insinuated between the compress and most projecting point of the vertebra, considerable pain was produced; and, when the apparatus was removed on the 24th, it was discovered that its pressure had occasioned a small slough, and so much ulceration, that the spinous process of the fourth lumbar vertebra actually pierced through the skin, where the cicatrix is still visible. The apparatus was discontinued, as experience had taught us how difficult it was to induce her ulcerations to heal under the use of ordinary dressings, it was determined to leave the healing process to nature. The patient was rigidly confined to the facial horizontal position, and a guard was placed over her back, to prevent the bed-clothes, or any thing else, from touching the wounded part. By this contrivance and plan, the formation of successive crusts or scabs was promoted, under which the small slough kindly separated, granulation and cicatrization gradually advanced, and the new skin or cicatrix became firm in about three months. Extension of the vertebræ was frequently employed during the healing process; and the constitution was improved by gentle alteratives, and a laxative of neutral salts with carbonate of soda exhibited every morning.

On December 20, the cicatrix was quite firm, and it was evident the projection of the vertebræ had diminished. The exten-

sion, pressure, and use of the apparatus were resumed; but the pressure was chiefly made on the transverse processes of the lumbar vertebræ, and on the spinous processes above the wound, by which the danger of reproducing ulcerations of the cicatrix was avoided. In the meantime, the child's health had much improved; her sleep had become placid and continued; her pains had greatly diminished, and recurred less frequently; and she was regaining flesh and strength. The apparatus was taken off, and reapplied three times a week, when extension and pressure were also employed as long as the patient could bear them without considerable pain. In March, her mother informed me that my patient could no longer be voluntarily confined to bed, and, maugre the fear of punishment, availed herself of many opportunities of walking about when the family duties of the mother required her absence from home: indeed, on my visit on March 27th, she was playing in a cart. On examining her attitudes, it was found she could firmly stand upright, and perform the different motions of the body, without pain or difficulty; and instead of stooping or inclining forwards, she rather bent backwards, indicating that the axis of the vertebræ is now posterior to the natural centre of gravity of the body, instead of being anterior, as was the case when the treatment commenced. She was therefore permitted to exercise as much as she desired, but enjoined to observe the fatal horizontal position when in bed, and to continue the use of the apparatus. The spinous process of the fourth lumbar vertebra still projected one quarter of an inch beyond the spinous process of the fifth: this has gradually diminished; and, on being examined on August 31st, she was in the full enjoyment of health, of erect position, of muscular power of all the movements of the body, and, instead of any projection, the lower dorsal and lumbar vertebræ had regained their natural inflection or bent inwards. The spinous process of the fourth lumbar vertebra is still a little larger than natural. During the treatment, the inward bend of the right foot, and the contraction of the hamstrings were removed.

CASE 2. — Mary Howell, æt. five years, six months, one of five children, born of healthy parents, neither of whom had been affected with scrofula, residing at No. 1, Hector Place, Crawford Street, has light hair and eyes, and a delicate white skin. The distortion had been observed five months, when admitted a patient at the Marylebone station of the Royal Metropolitan Infirmary, on August 9th, 1821. The projection had been gradually formed; two spinous processes had been first observed to protrude outwards, and as the projection of these increased, they appeared to bear out the six spinous processes of the vertebræ immediately above them. At present the projection comprehends four lower dorsal, and four upper lumbar vertebræ. The spinous process of the fourth lumbar vertebra forms the greatest point of projection, and protrudes from its proper situation about five-eighths of an inch beyond the spinous process of the fifth. From the spinous

process of the eighth dorsal vertebra, which is *in situ*, the projection beyond the spinal line of the spinous processes of each vertebra below it, gradually increases, till it arrives at the angular point formed by the extremity of the spinous process of the fourth lumbar vertebra. Between the spinous processes of the fourth and fifth lumbar vertebræ, there is a space, as in the last case, in which a finger may be laid. The transverse processes of the third and fourth lumbar vertebræ can be distinctly felt to project on each side of the spinous processes, and together, they form an arc from side to side, as described in the last case. The muscular powers gradually diminished, more especially those of the back and of the lower extremities; she became weak and soon tired; she could not walk much without sitting or lying down as if exhausted; she frequently waddled, crossed her legs, and fell down; the back is painful, and the pain has sometimes prevented sleep; on all occasions, when taking exercise, she attempts to lean on everything that comes in her route, and frequently supports herself by stooping forwards, and placing her hands above her knees. The appetite is tolerable, but the bowels are not regular. An alterative pill was ordered every night, and a gentle aperient every morning. Extension of the body, and pressure on the projecting vertebræ, were employed; a compress, pad, and shield, were applied over the projection, and retained by a long broad bandage rolled round the body. The patient was confined to the facial horizontal position, and the apparatus was taken off and re-applied three times a week, after the usual extension and pressure had been employed. The patient was very irritable and obstinate, and generally resisted the regular manipulations as much as she could; she also, in a very short time, effectually overcame all her mother's attempts to induce her to take any medicine. Nevertheless, by a continuance of the means mentioned in the most effective manner such a case would allow us to use them, the patient, in three months, recovered the power of walking and running in the erect attitude, without fatigue or stooping. The apparatus was, however, continued, and the mother was directed to keep her alternately to the facial and dorsal horizontal positions, when she was not engaged in exercise. During her confinement to bed, she regained appetite, strength, and flesh. The projection was not entirely removed. In October she began to complain of occasional, and sometimes severe, pains in her right knee, more particularly at night; yet no alteration in the appearance of the knee was observable, now, or at any succeeding period of the disease. At this period, a suspicion of incipient diseased hip-joint was awakened, but no appearance or sensation about the joint rendered it manifest. At my visit on November 20th, the characteristic symptoms of morbus coxaris became displayed; the extremity was elongated and emaciated; the nates were flattened; and the natural fold of the integuments at the edge of the glutæi muscles was lower on the thigh than on the other extremity. There were tenderness and some pain on

pressure behind the trochanter major. The tic douloureux-like pains of the knee occasioned agonizing screams and sleepless nights; still the patient could not be induced to take any medicine. Leeches were, at successive periods, applied around the hip-joint, but without preventing suppuration.

Every experienced surgeon must have remarked that, in the *ordinary* recumbent posture in bed, the thigh affected is drawn forward or upwards in the early stage of the disease; and when, and after, suppuration has taken place, the thigh becomes shortened, and the flexor muscles of the thigh contract so powerfully as to draw the thigh towards the abdomen. From this contraction of the flexor muscles becoming permanent, or from being accompanied with dislocation of the head of the os femoris, I have seen some instances of permanent lameness arising from the inability to place the thigh in a line perpendicular to the axis of the body; and many persons lame from this cause may be seen walking in our streets. To counteract this cause of lameness, arising out of the disposition to permanent contraction of the flexor muscles of the thigh, and to dislocation of the head of the thigh-bone, I determined still to retain my patient in the facial horizontal position, and to keep the extremity extended as much as possible in that posture, — that is, with the patella pressing on the bed by the weight of the extremity, and a gently extending power applied to the ankle. By this position, the flexor muscles of the thigh situated within the pelvis and abdomen, now in a state of unnatural contraction, would be more particularly put on the stretch, and, from their insertion in the transverse process of the twelfth dorsal, and all the lumbar vertebræ, would necessarily draw those vertebræ inwards, and strongly promote the cure of their remaining projection, or curvature outwards. Indeed, one instance has fallen under my observation of an incurvation of the lumbar vertebræ from the permanent contraction of these muscles.

By degrees, the exterior parts around the thigh-joint enlarged, the skin became shining, the thigh shortened, and a fluctuation was perceptible. On the 2d of February, the abscess opened behind and below the trochanter major, and discharged a large quantity of scrofulous pus, thin and intermixed with cheesy or curd-like substances. On April 15, the abscess formed another opening below the trochanter minor, from which, in the position she lay, the pus obtained a more ready outlet. No application was used but the ordinary cataplasm, and no medicine could be given. No symptom of hectic fever supervened; and although she became much emaciated, yet her appetite was fortunately good, and her bowels regular. The swelling and discharge diminished slowly. The case was proceeding more favourably than was expected, the result being still doubtful, when she was assailed, on the 18th June, by the eruptive fever of variola, followed by a very numerous crop of pustules all over the body: her mother contrived to make her take some febrifuge aperient medicines

during the disease, and she was smartly purged after the stages of the disease had been passed through. During the period of small-pox, the discharge from the abscess around the hip-joint rapidly diminished, and, in three weeks from the termination of small-pox, they had quite healed and ceased to discharge. On being allowed to exercise, she was soon enabled to walk with her right extremity perpendicular to the axis of the body, without the slightest lameness. During her confinement, the vertebræ had regained their natural position, or, rather, the axis of the body was thrown a little backwards.

August 31.—On examining her to-day, for the purpose of publication, it was found that the use of the right hip-joint and extremity were as perfect as those of the left; that the body possessed the erect attitude, and all its locomotive powers; and that the spine had acquired the natural inflection of the lower dorsal and lumbar vertebræ, instead of the outward distortion. The points of the spinous processes of the third and fourth lumbar vertebræ remain a little enlarged as in the last case, and require a little more of the action of the absorbents.

In this case it would seem as if the eruption of small-pox acted, as it were, by metastasis, in transferring the secretion of pus from around the hip-joint to the skin; or the salutary mode of action may have been by counter-irritation; for, from the period of small-pox eruption, the recovery from morbus coxaris was strikingly rapid. The probability of facial horizontal position, with extension, having counteracted the contraction of the psoæ and iliaci muscles, and prevented the chance of a dislocation of the head of the femur, which sometimes ensues, may be worthy of notice, if not of imitation; and it is trusted some cases now under treatment will have a similar result.

CASE 3.—Harriet Pittam, æt. five, No. 19, Wimpole Mews, on May 16th, 1822, was admitted a patient of the Marylebone station of the Royal Metropolitan Infirmary. She is one of two children, both of whom are affected with spinal distortion; the mother is healthy, the father is of a scrofulous constitution. Harriet's eyes, hair, and countenance, are dark; she looks lively, and is tolerably stout. Her upper lip had been thick and chapped, and so far a scrofulous diathesis was indicated. In June, 1821, she began to be affected with pains of her right knee, resembling those of tic douloureux, that were most severe during the night, and deprived her of sleep when they occurred. In August, a projection of the lumbar portion of the spinal column was first observed: from this period, the body could not assume the perfectly erect attitude, but bent forward, and she could not stand a minute without supporting herself by placing her hands on her knees. In February of this year, a swelling of the groin and upper part of the left thigh, attended with pain, was noticed, which gradually extended to the whole extremity, without producing any abatement of the occasional and violent pain of the knee. The child had been an out-

patient of Westminster Hospital. At this period (May 16th), there is great swelling of the upper part of the thigh, irregular, and in appearance like swelled glands, extending to the labium pudendi and above Poupart's ligament on the same side. The whole left extremity is as large again as the other; the integuments about the groin and upper part of the thigh are red and inflamed, and much pain is excited by pressing either immediately above or below Poupart's ligament. There is no fever. The bowels are disposed to constipation, and her nights are restless.

There is an angular projection of the spine. The point of greatest projection is the inferior part of the spinous process of the third lumbar vertebra, and, in the erect attitude, this spinous process projects five-eighths of an inch beyond the spinal line; leaves a space between it and the upper part of the spinous process of the fourth lumbar vertebra *in situ*, and, as it were, forces out with it the eight spinous processes above, so that the whole form a gradually projecting line of an acute angle. This appearance of the spinous processes is, for the most part, relative; for, although they are borne out, or raised up, by the enlargement and protrusion of the processes of the second and third lumbar vertebræ, and are proportionately removed from the proper axis of the spinal column, yet the spinous processes of the five lower dorsal and first upper lumbar vertebræ are *in situ*, as far as they are respectively related to those immediately in contact with them; for there is no unnatural space left between their spinous processes, as there is between those of the third and fourth lumbar vertebræ and the two above them.

To take off all superincumbent weight from the spinal column, and to enable the pus of the psoas abscess to take a depending position, the patient was permanently confined to the facial horizontal position; an explanation of the propriety and advantages of which position, in excorvations of the spine and angular projections outwards, was attempted, when the subject of proper position in spinous distortions was discussed.

To correct the stromous habit, to obviate constipation, and to promote absorption of pus, an alterative was directed to be taken every night, and a gentle aperient every morning. The applications to the back were the same as in the preceding cases.

May 21.—The back is easy, the bowels are regular, the appetite is good, she sleeps well; but the groin is still red, inflamed and painful.—Appl. Hirud. iv. et cont. med.

23.—Two leeches were repeated; and from this period the swelling and inflammation of the leg and thigh gradually abated.—Cont. med.

June 6th.—The patient has been considerably better on the whole, although the pains of the knee have on some nights prevented sleep; the bowels have been regular, and the appetite good; the groin is still painful, and the integuments are slightly inflamed; the projection of the spine diminishes.—Rep. Hirud. ij. et cont. med.

18.—The swelling and inflammation of the extremity dimi-

nish; the fluctuation of pus on the inside of the thigh is felt with more distinctness; the bowels are regular; the *tic douloureux*-like pain of the knee has been so severe that the child has been obliged to scream in the night for hours together, and was only relieved by her mother binding towels tight round the knee, and administering six drops of laudanum. The friction of an opiate ointment, and the firm application of a bandage to the knee afterwards, had not the desired effect of preventing the recurrence of this pain. One grain and a quarter of *pulv. ipecac. co.* given every night at bed-time, succeeded in keeping this dreadful visitor aloof, and the nights again became devoted to ease and sleep.

On the 29th, the greatest projection of the spinous process of the fourth lumbar vertebra was only a little more than one-eighth of an inch. The alterative, the aperient, and anodyne, with the mechanical parts of the treatment, were persevered in; and from the diminution of the swelling of the extremity, and of the size of the psoas abscess and its parietes, — from the animal and vital functions being well performed, — and from the expression of health and amendment observed in the countenance, flattering, but transitory, prospects of ultimate success animated our efforts, while the minds of her parents were cheered with hope.

During the night of July 2d, she was seized with pain of the stomach and head, which were followed by copious vomiting; the vomiting became incessant, and every thing swallowed was directly rejected; headache continued; fever was induced, with a quick pulse, and hot skin; the bowels had acted freely. It was necessarily apprehended that no fluid medicine would be retained in the stomach, she was ordered a combination of calomel, *p. jalapæ*, and *pulv. antimon.* in pills, with cold applications to the head. The regimen consisted in frequently administering a tablespoonful, *only*, of toast and water or tea; by a strict adherence to which, the irritability of the stomach was appeased, and the power of retention restored.*

July 3. — The bowels have been freely evacuated, but the headache has greatly increased, and is diffused all over it; she has screamed much, and is commonly insensible; blood was drawn from the head, the hair was cut off, and evaporating lotions were applied to the head, which quickly restored her senses; and the same medicines were persevered in.

4th. — In the morning, all the symptoms were considerably relieved, but in the afternoon they returned with more violence, and Dr. Macleod was so kind as to visit the patient, and directed a free abstraction of blood from the head, and the use of calomel and antimony. In the evening, she was relieved; but the bowels

* The rationale of appeasing irritability of the stomach by this regimen is explained in *Practical Treatises on Tropical Scorbutic Dysentery*, p. 132-4, by the author of this Essay.

had not acted, and a purgative of salts and senna was exhibited, which operated most copiously.

6th. — Strabismus is induced; the left eye is drawn inwards; the pupils are greatly dilated, and are insensible to light; the child lays in a stupor; the hand is lifted to the head; the pulse is quick; the skin is pale, and its temperature is not increased. These have been considered obvious symptoms of effusion in the brain, but in this case proved not to be so. Blisters were ordered behind the ears, and the head rubbed with the Ung. Hydr. fort. Dr. Macleod prescribed Tr. Digitalis; but no remedy produced permanent advantage, and she expired on the 11th.

Necrotomy was performed in the presence of Dr. Macleod, Dr. R. Harrison, &c. We sawed through the posterior bony covering of the spinal canal, and raised the posterior parts of the vertebræ. The medulla spinalis, on minute investigation, appeared perfectly healthy; the anterior portion of the spinal canal preserved its integrity, and no unevenness was there observable from displacement of bone, thickening or relaxation of ligament, or from any cause; but the posterior portion of the spinal canal was enlarged, as will be soon explained. The spinous and transverse processes of the first, second, and third lumbar vertebræ are preternaturally enlarged; and appear to be the principal cause of the spinous projection; or, in fact, this morbid enlargement constitutes, in a very great degree, the projection itself. It is strikingly remarkable that the transverse processes of the third lumbar vertebra on each side overlap posteriorly the transverse processes of the fourth, by which the spinous process of the third lumbar vertebra is thrown back, and forms the greatest projecting or angular point; and by which also, the superior oblique process of the fourth lumbar vertebra reaches so high on the upper part of the transverse process as to be within one line of the inferior oblique process of the second lumbar vertebra; whilst the distance of the superior oblique process of the third is four lines from the inferior oblique process of the first lumbar vertebra. The consequence of this derangement of structure on the posterior part of the spinal conduit, is that the dimensions of the canal are enlarged posteriorly, where the transverse and spinous processes of the second and third lumbar vertebræ protrude backwards, so as to form an irregular excavation extending nearly one-fourth of an inch beyond the natural circumference of the canal.

It has been denied by a late writer, that any curvature of the spine is caused by an undue growth of the bony parts of the vertebræ, and the fact established by this dissection is somewhat new; but it has not been difficult to explain the mode in which an undue growth, and consequent enlargement, of some of the bodies and processes of the vertebræ can remove the spinal column from its proper axis, and produce every species of distortion and curvature.

On examining the abdomen and thorax, we found all the contained viscera in a healthy state; and, on dissecting out the bodies

of the vertebræ, we could not detect any relaxation of ligaments, or any disease of the bone or intervertebral cartilages: neither was there any "luxation or sub-luxation" evident. We opened the psoas abscess over the psoæ muscles, when a pint or more of matter flowed out, that did not present the characteristic appearance of scrofulous pus; and on passing the hands from the loin under Poupart's ligament to the termination of the parietes of the abscess on the inside of the thigh, we found the matter had been contained in a thick membranous-like pouch, that had not pressed on or affected the bodies of the lumbar vertebræ. Parts of the brain displayed the usual marks of inflammation. There was increased vascularity of the arachnoid membrane, and some effusion of fluid between this tunic and the pia mater. About the fissura magna sylvii, on the left side, patches of coagulable lymph had created an adhesion between the tunica arachnoides and pia mater. The ventricles could not, with strict precision, be said to contain a quantity of serous fluid, more than is met with in ordinary cases, where the brain is dissected; but the sides of the left ventricle were united by bands of coagulable lymph. From these appearances, it was concluded that the patient had died from inflammation of the brain, and not from effusion, as had been suspected from the symptoms.

CASE 4. — Eliza Pittam, æt. eight, the sister of Harriet, was affected at the same time with excurvation of the dorsal vertebræ projecting backwards three-quarters of an inch beyond the spinal line. The treatment recommended in this Essay was duly observed in her case in all particulars, and she went into the country on the 13th September, with the curvature almost cured; but the muscles of the back were weak, and she could only walk a short time without fatigue. She was enjoined the use of the apparatus, and the alternation of exercises, and the use of the recumbent posture in the country. In the month of June in the following year, her mother called on me to inform me that the child had quite recovered from the excurvation, but was also seized with inflammation of the brain in March, and died.

THE END.





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